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FLIGHT TEST OF A COMPOSITE MULTI-TUBULAR SPAR MAIN ROTOR BLADE ON THE AH-1G HELICOPTER

Volume I - Materials, Design, and Test

Hughes Helicopters
Division of Summa Corporation
Culver City, Calif. 90230

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Prepared for

EUSTIS DIRECTORATE
U. S. ARMY AIR MOBILITY RESEARCH AND DEVELOPMENT LABORATORY
Fort Eustis, Va. 23604

EUSTIS DIRECTORATE POSITION STATEMENT

The work reported herein was performed under Contract DAAJ02-74-C-0055 with Hughes Helicopter Company, Culver City, California, and Fiber Science, Inc., Gardena, California, as primary contractor and subcontractor respectively.

The data contained in this report are the results of flight and laboratory testing. The reported work was performed to determine the applicability of the filament winding co-cure fabrication process, in conjunction with the Multi-tubular Spar concept, in fabricating helicopter rotor blades with improved fatigue life, ballistic damage tolerance, low radar cross-section signature, and low production cost.

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The objectives of this program were to design a composite main rotor blade in the multi-tubular spar configuration to be directly interchangeable (in pairs) with the production metal (540) blades on the AH-1G helicopter, have increased fatigue life, invulnerability to the 23mm ballistic threat, low radar cross section, and low fabrication cost. Manufacturing technology was developed and described in a Process Specification. Laboratory, ground, and flight tests demonstrated that the wet-filament wound, co-cured blade met, and in some cases surpassed, all objectives and could be adapted for Army service.

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PREFACE

This report was prepared by Hughes Helicopters, Division of Summa Corporation, Culver City, California 90230, for the U. S. Army Air Mobility Research and Development Laboratory, Fort Eustis, Virginia 23604, under Contract DAAJ02-74-C-0055.

Hughes Helicopters (HH) was the prime contractor and Fiber Science, Inc. (FSI) was the subcontractor. HH and FSI cooperated on the design, FSI fabricated the blades, and HH tested them. Mr. R. E. Head was HH program manager and Mr. L. J. Ashton was program manager at FSI. The Eustis Directorate technical monitors for the programs were Mr. I. E. Figge and Mr. N. J. Calapodas.

This final report on the development program for the composite multi-tubular spar (MTS) main rotor blade for the AH-1G helicopter is presented in three volumes: Volume I, Materials, Design, and Test; Volume II, Cost Estimates and Process Specifications; and Volume III (S), Ballistic Damage Tolerance and Radar Cross Section.

This volume documents the work done to establish composite material properties; to design the MTS blade; to develop the wet-filament winding (WFW) co-cure manufacturing process; and to evaluate the blade through laboratory, ground, and flight tests.

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INTRODUCTION

This volume describes the design of the multi-tubular spar (MTS) blade and testing to verify that the concept is viable for producing long-life, low-cost, ballistically tolerant composite main rotor blades.

The first step was establishing allowable loads for wet-filament-wound (WFW) components. The basic filament strength and stiffness had been documented, but information was needed on the specific characteristics, especially their fatigue characteristics, of WFW tubular and unidirectional filament components. Small specimens of both configurations were tested for static strength and stiffness in tension, compression, and shear, and their fatigue strength was documented. Compression/creep properties, static properties, and S-N data determined in these tests were used in the stress analysis of the blade.

Blade preliminary design work was concurrent with the materials test work. The basic blade design concept was established by the title of the program: "Multi-Tubular Spar." FSI and HH separately and together proposed a number of concepts for the blade, all based on the co-cure process. The midspan portion of the blade appeared amenable to any one of a number of different designs. The problems lay in the root and tip ends where a reliable mechanical connection between the midspan filaments and the end fittings was considered to be mandatory; reliance on interlaminar shear through the resin was to be avoided if at all possible. From nine root and six tip candidate designs, the final selection was made.

An integral part of the program was improving the WFW co-cure manufacturing technology to assure repeatable fabrication of aircraft quality primary structure components. A manufacturing technology program established the necessary processes and demonstrated them with two full-size "toolproofing" blades before building the eight blades for the test program. It was refined to the point where weight and center of gravity control had the same tolerances normally experienced with metal blade production technology. In going to a production composite blade program, even closer tolerances may be anticipated. The process specification used in fabricating the blades appears in Volume II.

HH and FSI cooperated in the final detail design of the blade with FSI preparing the engineering drawings, and HH performing the stress, weight, and dynamic analyses. This blade makes use of the WFW, co-cure process, has the dynamic characteristics necessary for operation on the AH-1G helicopter, has a calculated 3600-hour fatigue life, has ballistic tolerance to 23mm high explosive incendiary-tracer (HEI-T) projectiles, has low radar cross section compared with the production metal blade, is repairable, and can be produced at low cost.

Throughout the blade detail design process, close liaison was maintained between the tool designers and the WFW manufacturing engineers. Unlike aircraft structure where the designer can call for, say, an extrusion of a certain size made from some certain metal with a particular heat treat, the WFW components must be capable of: being wound in a reasonable shape (cylinder, cone, longo, etc), being moved from the winding machine to the blade mold, ending up in the mold in the proper location with the filaments going the proper direction(s), and, in certain instances, performing a built-in tooling function to aid in forcing all the components into their proper places in the mold. All this must be done while the resin remains in an uncured condition with pot life long enough to permit complete assembly before the resin is deliberately cured by the application of controlled heat and pressure as the final assembly process. As a result of this design/manufacturing integration, the MTS blade is a reliable structure that meets all the objectives of the program.

The laboratory tests for the full-scale MTS blade demonstrated that the blade strength, stiffness, and dynamic properties were suitable for flight. The eight blades were built as complete, full-length blades. All except the flight test blades were cut into segments with each segment assigned to a specific test. These tests, conducted in HH Structures Test Laboratory, established that the static and fatigue strength, stiffness, and dynamic characteristics of the MTS blade were in agreement with the predicted values, and that the concept was ready for ground and flight tests.

MTS blades were ground- and flight-tested on an AH-1G helicopter (Army S/N 67-15683), newly out of the Army's Corpus Christi Repair Depot. An instrumented 540 hub and two MTS blades were installed on the helicopter. The aircraft was tied to the ground for a 10-hour whirl test program, and then was flight tested for approximately 15 hours to explore 80 percent of the production AH-1G flight envelope. The ground test investigated the influence of rotor rpm, collective pitch setting, and cyclic pitch inputs. The flight tests covered a speed range up to 136 knots indicated airspeed (KIAS) and vertical accelerations between 0.3 and 1.9g. All basic AH-1G maneuvers except those that required ordnance firing were flown in this restricted envelope.

After the MTS blade flight test was completed, 540 metal blades were reinstalled on the helicopter, and a short program was flown for direct hub and mast loads comparison, and for a pilot qualitative comparison of the two blade systems. The pilot reported a smoother ride with the MTS blades, but otherwise no significant differences in handling qualities. The rotor loads measured for the MTS blades were the same as or a little lower than those for the 540 blades.

The success of this test program indicates that the all-composite MTS blade is a viable concept and should be introduced into an Army service evaluation program to establish its characteristics in the field.

SECTION I – PRELIMINARY DESIGN DEVELOPMENT

The MTS blade development work described in this section led to the detail design of the blade, and to the establishment of the blade fabrication process.

Allowable loads for WFW components were established. Small specimens of tubular and unidirectional filament configurations were tested for static strength and stiffness in tension, compression, and shear. Their fatigue strength was documented through tension-tension fatigue tests. Compression/creep properties were also established for temperatures ranging from -95° F to +160° F. The static properties and S/N data thus determined were used in the stress analysis of the blade.

MATERIAL PROPERTIES INVESTIGATION

The initial selection of materials for the MTS blade was based on FSI's previous experience with WFW structures. This indicated that only three filaments were worthy of consideration:

a. S-1014 fiberglass filaments (Ferro Corporation)

b. Thornel-300 graphite filaments (Union Carbide Corporation)

c. Kevlar-49 aramid filaments (DuPont Corporation)

Table 1 shows their basic physical properties.

TABLE 1. COMPOSITE MATERIALS PHYSICAL PROPERTIES

Material	Density (lb/in.^{3})	Ultimate Strength Tension (psi)	Ultimate Strength Compression (psi)	Stiffness Tension (10^6 psi)	Stiffness Shear (10^6 psi)
Kevlar-49 Aramid Filament	0.0524	325,000	70,000	19.0	0.30
Thornel-300 Graphite Filament	0.0636	325,000	215,000	34.0	3.50
S-1014 Fiberglass Filament	0.0900	325,000	215,000	12.6	5.20
APCO 2434/2347 Resin	0.0412	-	-	-	-
APCO 2434/2340 Resin	0.0412	-	-	-	-

Data supplied by material manufacturers

Prior to this Contract, FSI, in conjunction with Applied Plastics Corporation (APCO) of El Segundo, California, investigated epoxy resin systems that were compatible with the WFW process. The principal combinations investigated were:

a. APCO 2434/2347* - 250°F cure

b. APCO 2434[illegible]0 - room temperature cure

c. APCO 2450/2[illegible]41 - two-phase resin

d. APCO 2450/2342 - two-phase resin

e. APCO 2430A/2347 - brominated resin

The two-phase resins were supposed to improve fatigue strength and the brominated resin was fire retardant but these three resins showed inferior fatigue strength characteristics so were rejected from further consideration.

A test program was conducted to evaluate structural properties of WFW materials. Three configurations of test specimens were used: tubular, "fan belt", and cylindrical. Tests were made on a total of 169 individual specimens to determine the static and fatigue strength of the candidate blade materials.

Tubular specimens, Figure 1, were wet-filament wound as a hollow tube with test-fixture end pieces integrally wound on at each end. The wrap angle terminology for test specimens is shown in Figure 2. Some tubular specimens were tested in an undamaged state; others were tested in a damaged condition, i.e., with a 0.25-inch diameter hole drilled through and with a 5.56 mm API bullet shot through.

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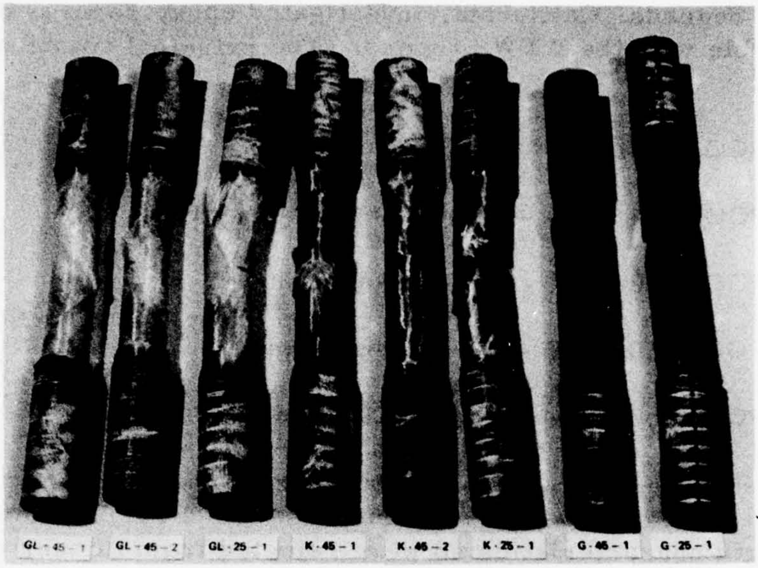
*Number before the slash mark denotes resin, number after the slash denotes hardener.



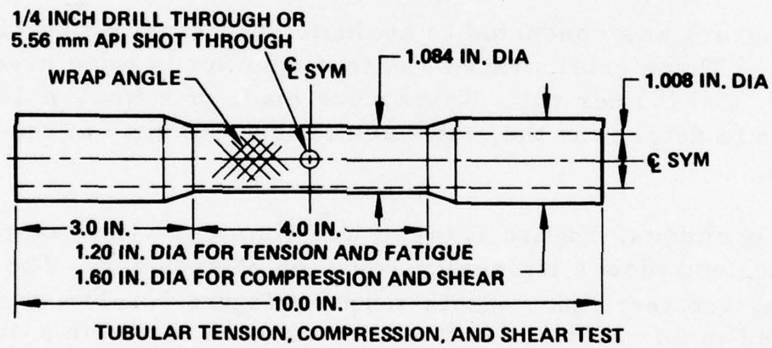


Figure 1. Tubular test specimens.

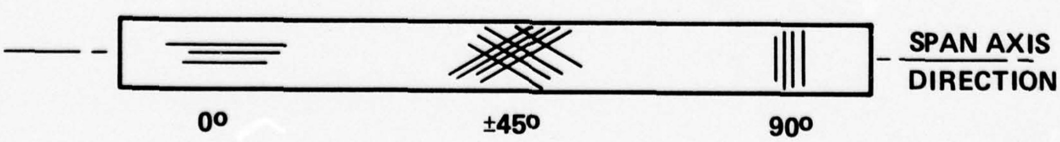


Figure 2. Wrap angle terminology.

The "fan belt" specimens, Figure 3, were fabricated by wet-filament winding a band of unidirectional filaments around grooved-disc, metal end fittings.

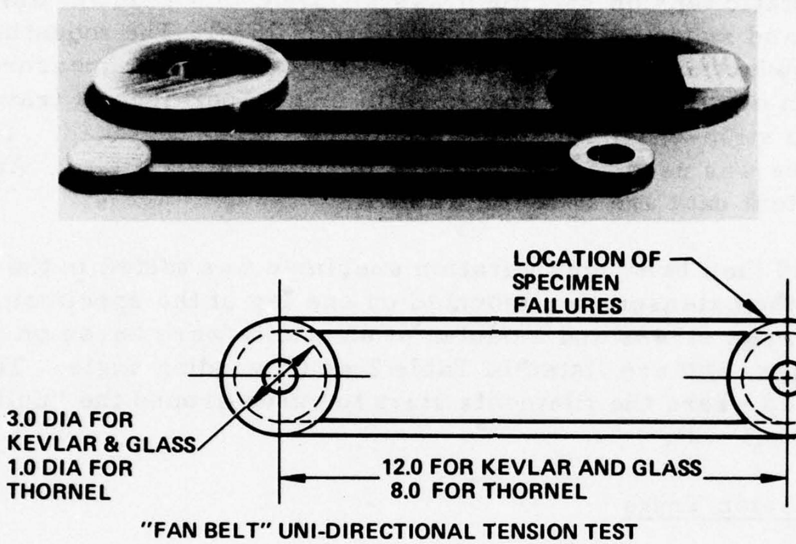


Figure 3. "Fan belt" test specimens.

The cylindrical specimens, Figure 4, were wet-filament, hoop wound as a hollow cylinder with the middle being S-glass and each end Kevlar-49.

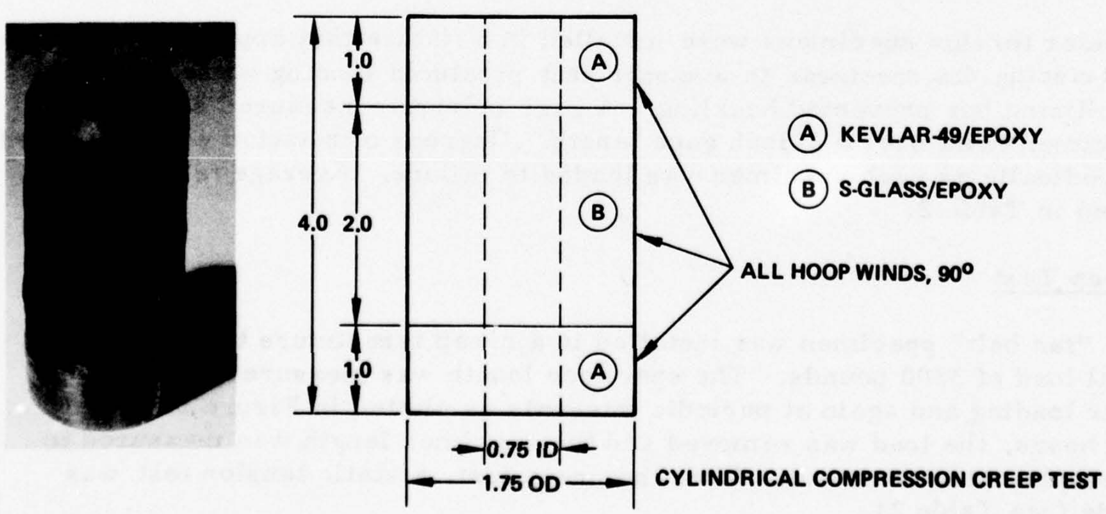


Figure 4. Cylindrical test specimen.

Static Tension Tests

Each tubular static tension specimen was installed in a Baldwin Universal Test Machine and static loads were applied to failure. The mounting precluded the introduction of bending loads. An extensometer measured the axial deflection of each tubular specimen in inches-per-inch of travel, and a load-deflection strip-chart recorder monitored the applied load. The load-deflection curve was used to calculate the modulus of elasticity. Average static tension test data are listed in Table 2.

Each Kevlar-49 "fan belt" configuration specimen was tested in the same manner, with the extensometer mounted on one leg of the specimen. The calculated ultimate stress and modulus of elasticity were based on the total area of both legs, and are listed in Table 2 as 0° winding angle. The failures always occurred where the filaments start to curve around the "pulley", as shown in Figure 3.

Static Compression Tests

Static compression tests were conducted on tubular specimens only. A stabilizing bar inside each specimen prevented buckling, and an extensometer measured deflection. The load-deflection strip-chart recorder monitored the applied load and the load-deflection curve was used in calculating the modulus of elasticity. Each compression specimen was tested to failure. Table 2 lists the average test results.

Static Shear (Torsion) Tests

Tubular torsion specimens were installed in a fixture that applied shear loads by twisting the specimens in a manner that precluded bending while an internal stabilizing bar prevented buckling. A gage indicator measured degrees of specimen twist over a 2-inch gage length. Degrees of rotation were recorded periodically as each specimen was loaded to failure. Average test data are listed in Table 2.

Creep Test

One "fan belt" specimen was installed in a creep test fixture that applied an axial load of 3500 pounds. The specimen length was measured immediately after loading and again at periodic intervals as plotted in Figure 5. After 100 hours, the load was removed and the specimen length was measured to determine permanent set. After the creep test, a static tension test was made (see Table 2).

TABLE 2. AVERAGE ULTIMATE STATIC STRENGTH AND STIFFNESS TEST DATA

	Tension		Compression		Shear	
	Stress (psi)	Modulus (10^6 psi)	Stress (psi)	Modulus (10^6 psi)	Stress (psi)	Modulus (10^6 psi)
K 0 A U	130,900	9.21	-	-	-	-
K 25 A U	94,460	3.84	13,490	3.24	11,880	1.31
D	37,430	3.71	-	-	-	-
K 45 A U	20,380	0.86	13,500	2.57	12,220	1.73
D	14,880	0.85	-	-	-	-
K 45 A(T) U	-	-	-	-	24,860	1.97
K 15/45 A U	74,970	3.87	16,690	3.31	14,350	1.43
D	36,450	3.86	-	-	-	-
K 45 B U	75,820	3.43	-	-	-	-
K 25 C U	84,370	5.18	13,180	4.50	9,940	1.06
K 45 C U	-	-	10,500	0.85	11,770	1.91
K 45 D U	-	-	13,320	0.96	15,000	2.29
K 15/45 D U	56,560	3.55	-	-	-	-
G 25 A U	73,720	6.46	-	-	-	-
G 45 A U	15,260	1.50	-	-	-	-
G 25 B U	68,920	5.59	-	-	-	-
G 45 B U	16,950	1.55	-	-	-	-
G 25 C U	75,190	6.03	21,770	5.56	22,790	2.13
G 45 C U	-	-	17,490	-	32,840	2.66
GL 25 A U	94,270	4.19	-	-	-	-
GL 45 A U	25,310	1.88	-	-	37,440	1.59

TABLE 2 — Continued

	Tension		Compression		Shear	
	Stress (psi)	Modulus (10^6 psi)	Stress (psi)	Modulus (10^6 psi)	Stress (psi)	Modulus (10^6 psi)
GL 25 B U	85,030	3.72	-	-	-	-
GL 45 B U	22,160	1.55	-	-	-	-
GL 25 C U	-	-	17,030	4.12	13,140	1.06
GL 45 C U	-	-	9,920	1.46	12,590	1.89

Filament: K = Kevlar-49
G = Thornel 300
GL = S-Glass

Winding Angle: ± degrees
"0" denotes "fan-belt" specimen

Resin System: A = 2434/2347
B = 2450/2341
C = 2450/2342
D = 2430A/2347

(T) Designates thick-walled specimen

Condition: U = Undamaged
D = 1/4-inch-diameter drilled hole or 5.56mm bullet hole

K 25 A(T) U

Average fiber volume ratio equals 41 percent.

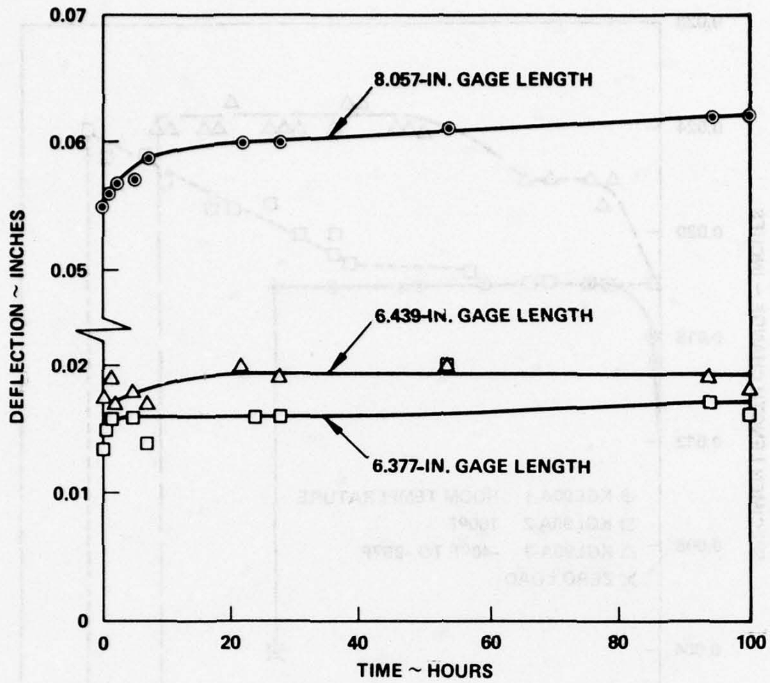


Figure 5. "Fan belt" configuration creep test — total deflection versus time.

Three cylindrical compression specimens were individually tested for creep. One specimen was tested at room temperature, one at 160° F, and one at -45° to -95° F. A measuring device recorded changes in length of the test specimen under a compression load of 2474 pounds. The data is plotted in Figure 6.

Fatigue Tests

Each end of each tubular fatigue test specimen was bonded to a set of grips and was installed in a constant-amplitude fatigue machine which ran at 30 hertz. An airstream passed through the test section of each specimen to keep it cool. Thermocouples on the inside and outside of the specimen monitored temperature, which was not allowed to exceed 95° F. The test machine had a safety device to prevent overloads and automatically shut down if the specimen failed.

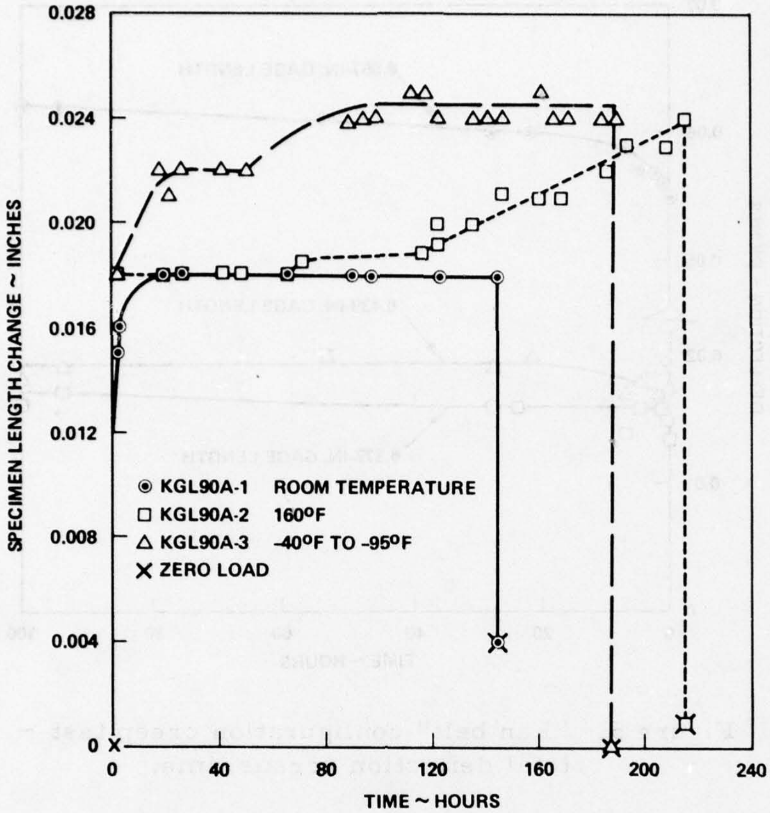


Figure 6. Cylindrical configuration compression creep test.

Each "fan belt" fatigue test specimen was installed in a test machine that used a hydraulic closed-loop servomechanism to apply and control the load cycle. The load was applied in the form of a sine wave and was monitored on a direct-reading oscilloscope. Safety devices prevented inadvertent overloads and shut down the system in event of a malfunction. Each "fan belt" fatigue specimen was tested at a rate of 20 hertz.

The tubular and "fan belt" fatigue specimens were tested at a load ratio of one-tenth; that is, the ratio of minimum load to maximum load was 0.1. Each specimen was tested to failure or until 10 million cycles had been applied, whichever occurred first. If a "runout" occurred (10 million cycles), the cyclic load was increased and testing continued until the specimen failed. Typical data for Kevlar-49 is plotted in Figures 7, 8, and 9 in the familiar load/cycle type of curve.

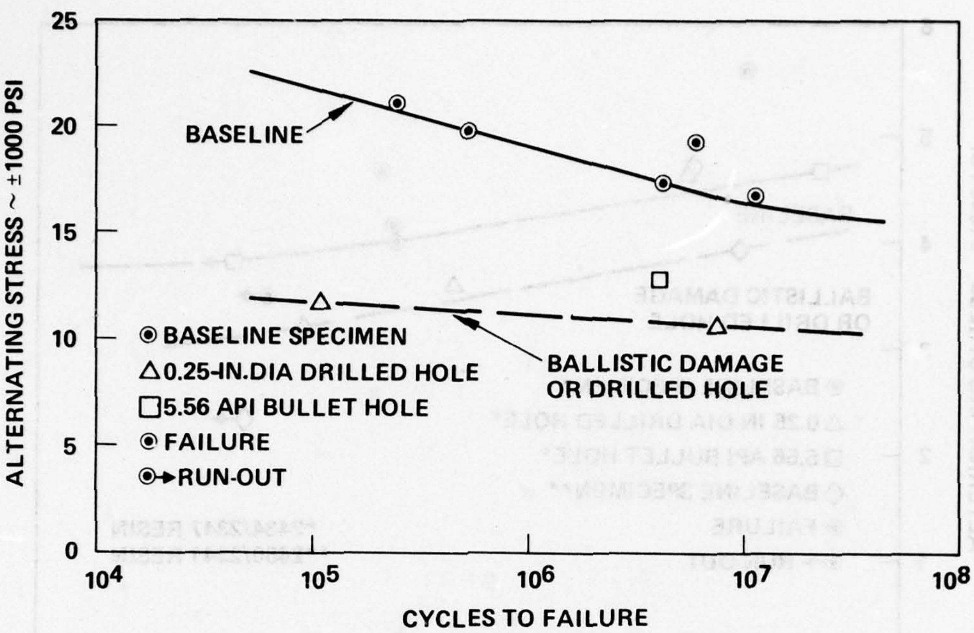


Figure 7. S-N curve for ±25° Kevlar-49/epoxy tubular specimen.

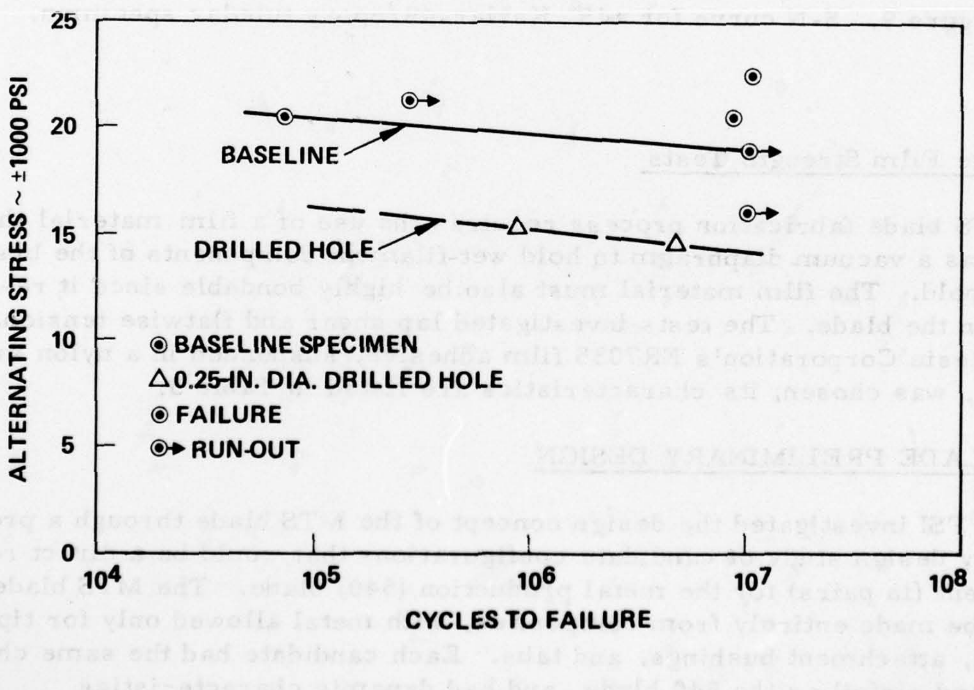


Figure 8. S-N curve for ±15°/±45° Kevlar-49/epoxy tubular specimen.

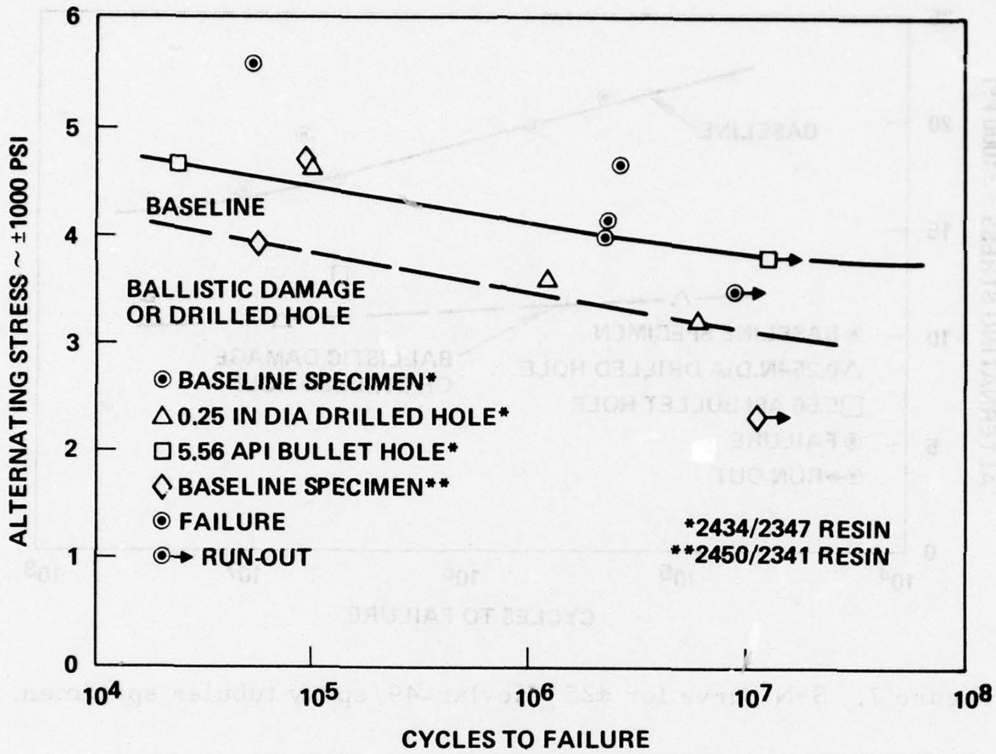


Figure 9. S-N curve for ±45° Kevlar-49/epoxy tubular specimen.

Bondable Film Strength Tests

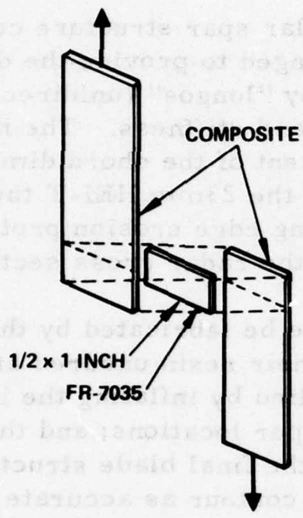
The MTS blade fabrication process requires the use of a film material that serves as a vacuum diaphragm to hold wet-filament components of the blade in the mold. The film material must also be highly bondable since it remains in the blade. The tests investigated lap shear and flatwise tension. Fiber Resin Corporation's FR7035 film adhesive, suspended in a nylon matte carrier, was chosen; its characteristics are listed in Table 3.

MTS BLADE PRELIMINARY DESIGN

HH and FSI investigated the design concept of the MTS blade through a preliminary design study of candidate configurations that would be a direct replacement (in pairs) for the metal production (540) blade. The MTS blade was to be made entirely from composites, with metal allowed only for tip weights, attachment bushings, and tabs. Each candidate had the same chord, twist, and airfoil as the 540 blade, and had dynamic characteristics

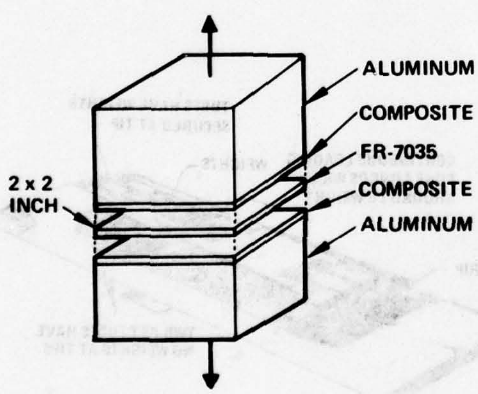
TABLE 3. FR-7035 FILM ADHESIVE SHEAR AND TENSION STRENGTH

SHEAR TEST



Material	Average Ultimate Shear (psi)
Kevlar-49[1]	1840
S-Glass[1]	3490
Thornel-300[1]	1280
Kevlar-49[2]	1260

TENSION TEST



Material	Average Ultimate Shear (psi)
S-Glass[1]	4700
Kevlar-49[1]	4700
Thornel-300[1]	1800

(1) APCO 2434/2347 Resin

(2) APCO 2434/2340 Resin

suitable for flight on the AH-1G. An alteration of the airfoil shape inboard of the 32-percent radius station (blade station (BS) 85) for root-end strengthening was permitted. Figure 10 provides the nomenclature used in describing the MTS blade.

The MTS blade is designed around a multiple tubular spar structure consisting of composite filaments formed as tubes, and arranged to provide the desired strength and stiffness. These are supplemented by "longos" (unidirectional longitudinal filaments) that furnish axial strength and stiffness. The main spar structure is spread over the forward 50 percent of the chord dimension of the blade to provide ballistic protection against the 23mm HEI-T threat. Each configuration incorporates nonmetallic leading edge erosion protection and radar-absorbing material (RAM) to minimize the radar cross section.

From the beginning, it was proposed that the blade be fabricated by the co-cure process: all elements of the blade with their resin uncured are placed in the closed-cavity mold; pressure is applied by inflating the internal spar tubes to force all the elements into their proper locations; and the resin is cured by heating the mold. In this way, the final blade structure is formed from the outside in -- giving a final blade contour as accurate as the mold, and leaving appropriate, preplanned spaces inside the blade structure

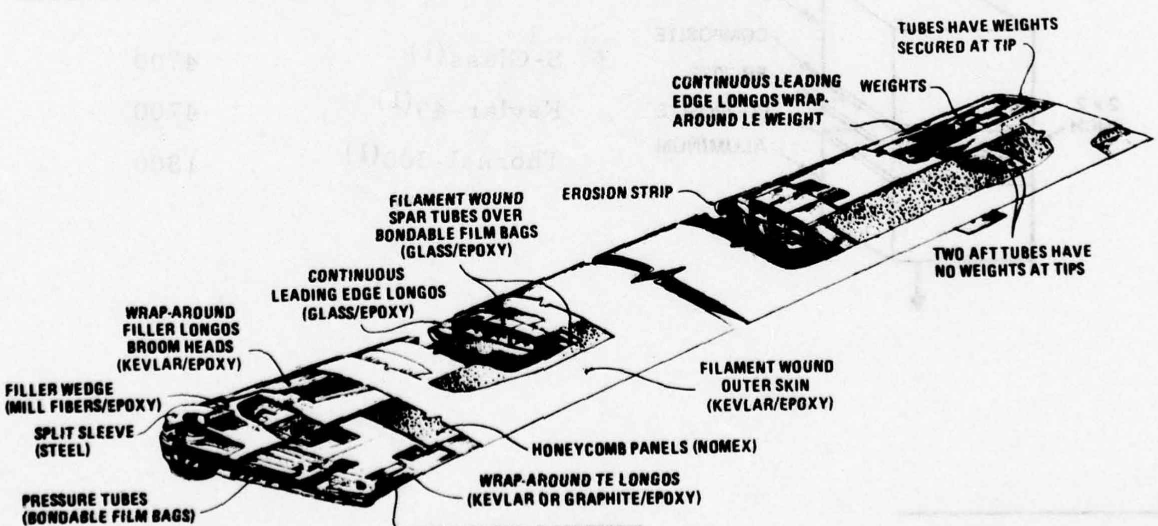


Figure 10. MTS blade nomenclature.

to accommodate tolerances. The co-cure process results in a very strong structure because all elements are forced into intimate contact while still in a soft, flexible condition. Then the resin is cured only once, creating a secure chemical bond.

The constant-airfoil, midspan section of the blade could be designed successfully in a number of configurations, but the main problem was integrating this section of the blade with a satisfactory root end and tip end. Designs in which a mechanical tie of the filaments was made to the metal components at the root and tip were judged to be more satisfactory than designs that relied on interlaminar shear through resins and adhesives.

Of the many configurations considered, nine root-end/midspan designs and six tip-end designs were considered for final evaluation and selection. These are discussed below.

Blade-Root/Midspan Configuration Descriptions

The basic blade structure sections for each configuration are shown in Figure 11 in which the vertical scale of the drawings is enlarged four times.

Configuration 1 (Figures 11 and 12). All spar longos wrap around the main retention bolt bushing. They are formed and precured into a C-shaped leading edge pack. Three filament-wound tubes, located just aft of the longos, formed the multi-tubular spar. A thick skin made from a flattened, filament-wound tube encloses the multi-tubular spars and the leading edge longos.

The trailing edge portion consists of thin honeycomb panels covered with a skin made from a filament-wound tube that has been cut open. The triangular cross section trailing edge longo wraps around the drag brace bushing, and two thin-walled filament-wound tubes complete the inner structure.

In the root area additional strength and flapwise bending stiffness is achieved by adding "broom longos" top and bottom just below the spar longos. This longo material runs predominantly spanwise in the blade, but fans out chordwise to the full width of the spar structure. It wraps around the main retention bushing for good mechanical attachment and extends out to the beginning of the constant section of the blade (BS 85). This is a feature of all blades shown here. It replaces the stack of doubler plates commonly used in metal blades, but is internal to the blade moldline rather than external.

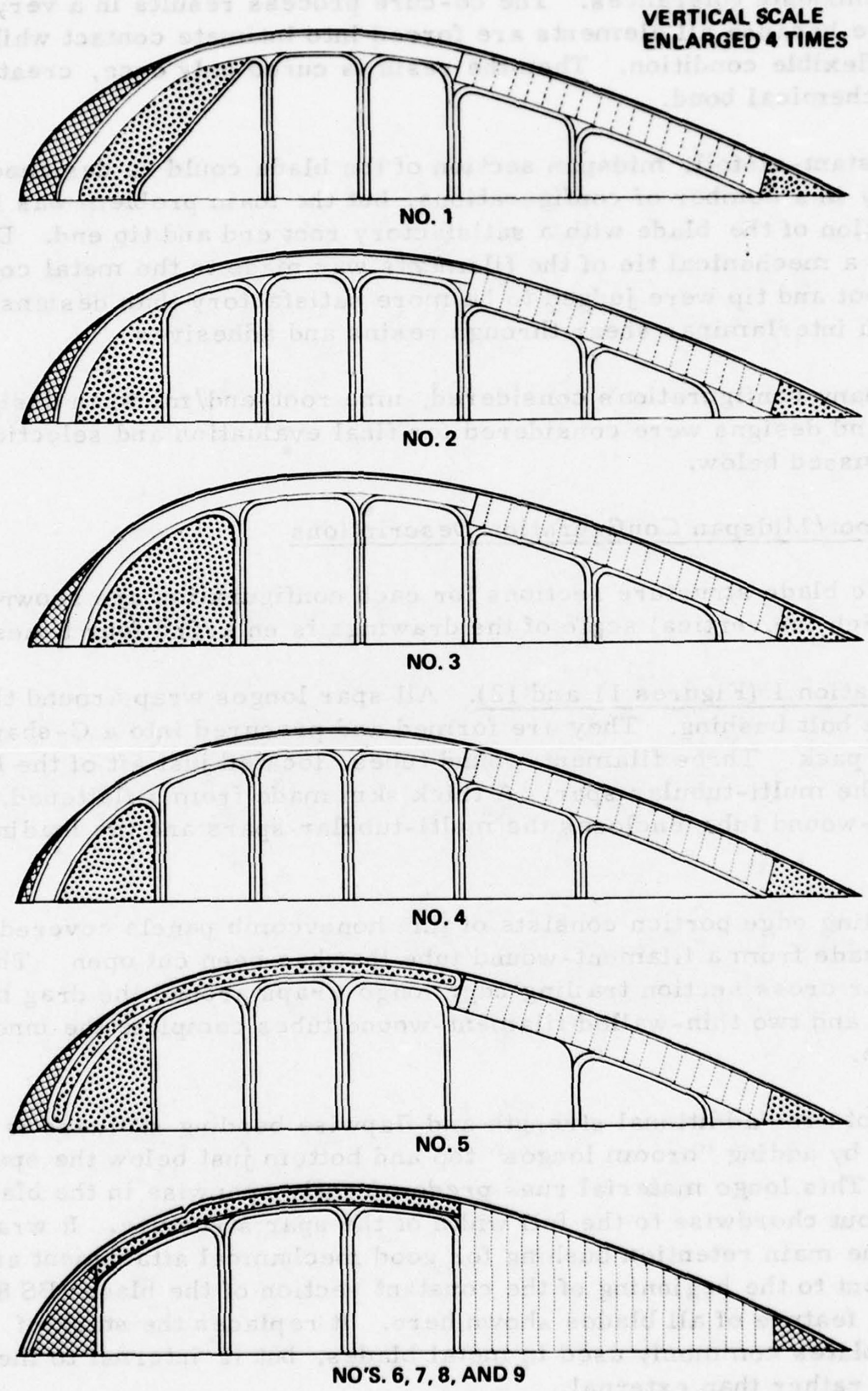


Figure 11. Basic blade structural sections.

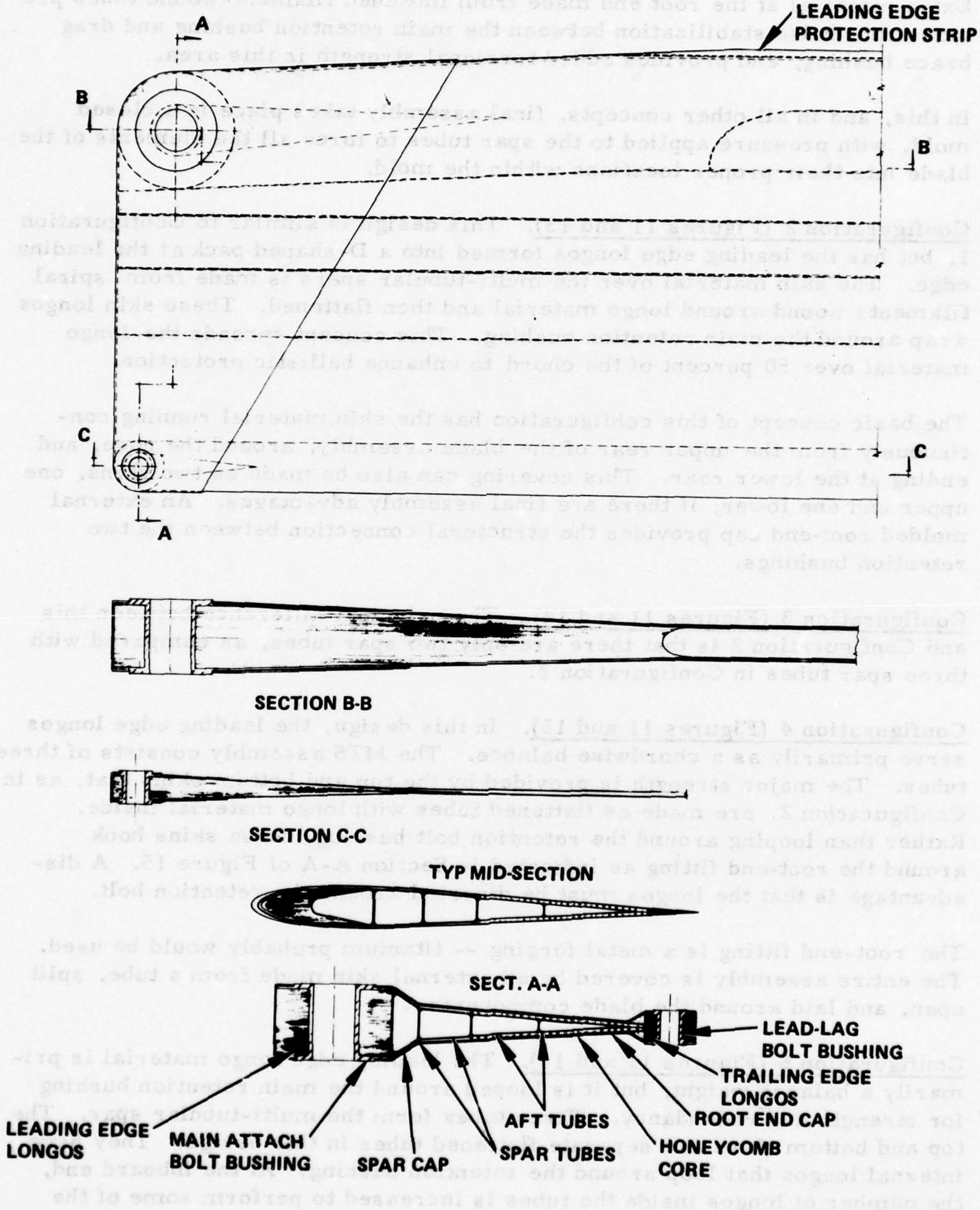


Figure 12. Blade root Configuration 1.

Extra material at the root end made from flattened filament-wound tubes provides chordwise stabilization between the main retention bushing and drag brace bushing, and provides added torsional strength in this area.

In this, and in all other concepts, final assembly takes place in a closed mold, with pressure applied to the spar tubes to force all the elements of the blade into their proper locations within the mold.

Configuration 2 (Figures 11 and 13). This design is similar to Configuration 1, but has the leading edge longos formed into a D-shaped pack at the leading edge. The skin material over the multi-tubular spars is made from spiral filaments wound around longo material and then flattened. These skin longos wrap around the main retention bushing. This concept spreads the longo material over 50 percent of the chord to enhance ballistic protection.

The basic concept of this configuration has the skin material running continuously from the upper rear of the blade assembly, around the nose, and ending at the lower rear. This covering can also be made as two skins, one upper and one lower, if there are final assembly advantages. An external molded root-end cap provides the structural connection between the two retention bushings.

Configuration 3 (Figures 11 and 14). The principal difference between this and Configuration 2 is that there are only two spar tubes, as compared with three spar tubes in Configuration 2.

Configuration 4 (Figures 11 and 15). In this design, the leading edge longos serve primarily as a chordwise balance. The MTS assembly consists of three tubes. The major strength is provided by the top and bottom skins that, as in Configuration 2, are made as flattened tubes with longo material inside. Rather than looping around the retention bolt bushing, these skins hook around the root-end fitting as indicated in Section A-A of Figure 15. A disadvantage is that the longos must be diverted around the retention bolt.

The root-end fitting is a metal forging -- titanium probably would be used. The entire assembly is covered by an external skin made from a tube, split open, and laid around the blade components.

Configuration 5 (Figures 11 and 16). The leading edge longo material is primarily a balance weight, but it is looped around the main retention bushing for strength and redundancy. Three tubes form the multi-tubular spar. The top and bottom skins are separate flattened tubes in this design. They have internal longos that loop around the retention bushing. At the inboard end, the number of longos inside the tubes is increased to perform some of the blade root doubler function. Broom longos are also used.

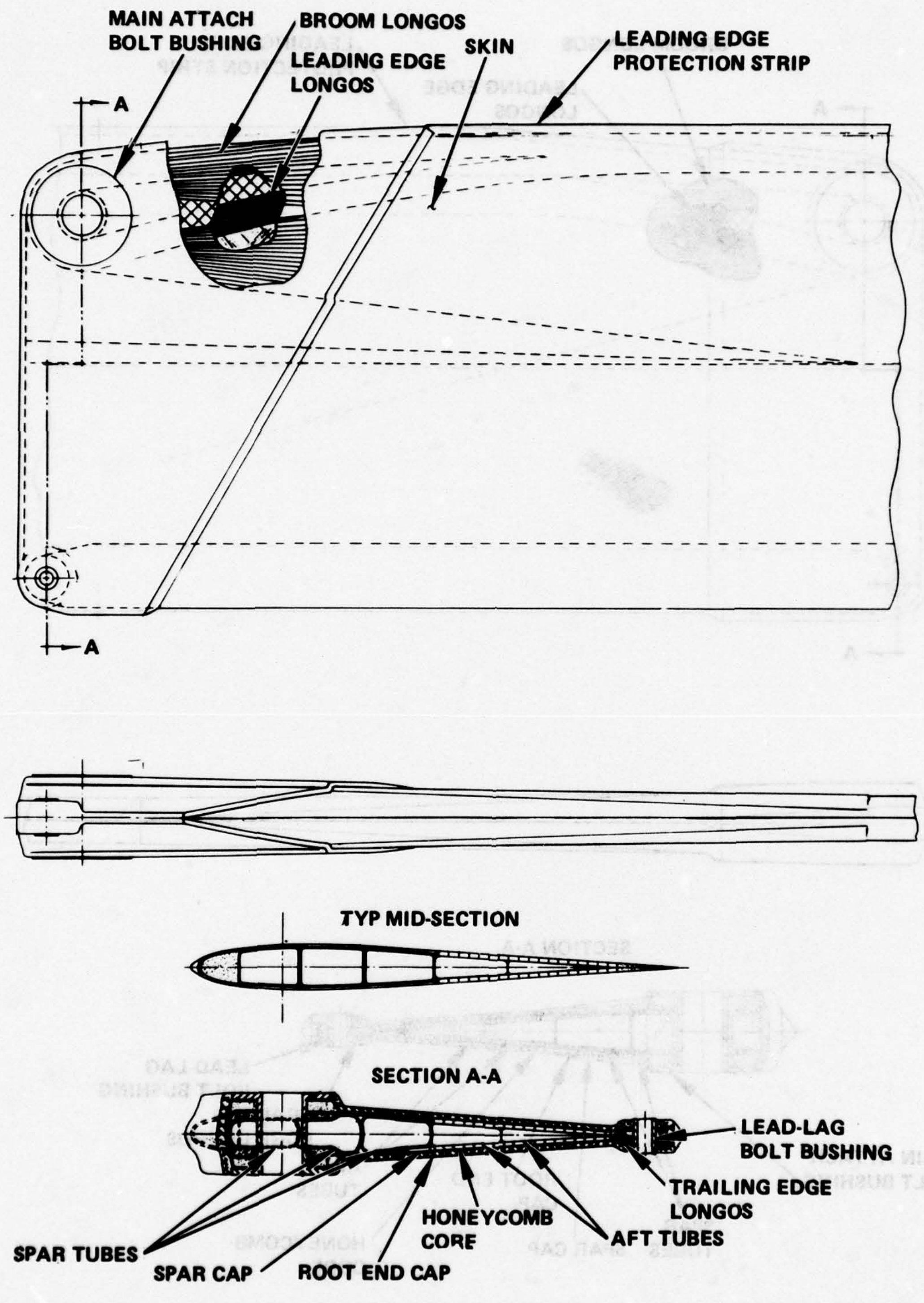


Figure 13. Blade root Configuration 2.

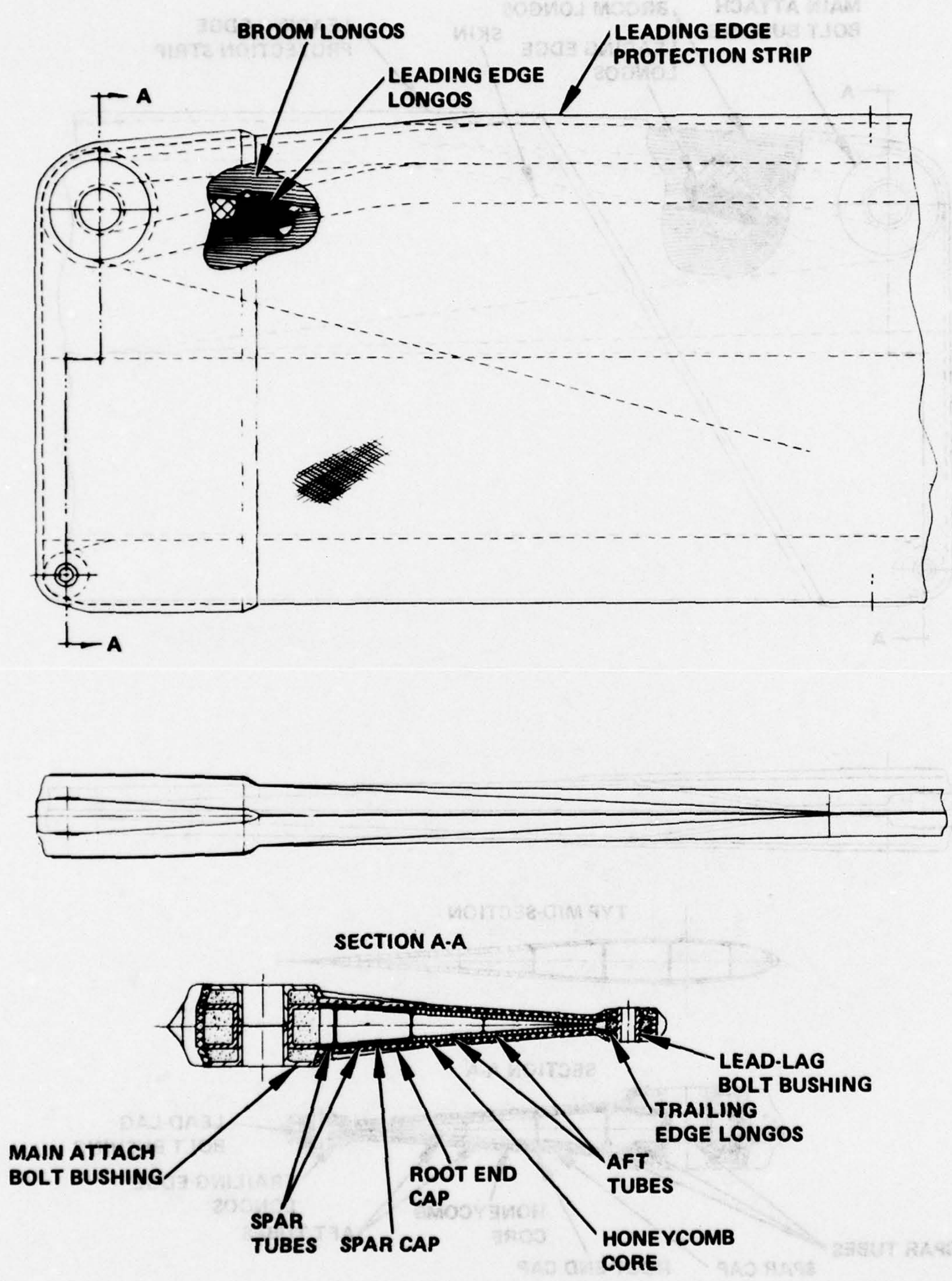


Figure 14. Blade root Configuration 3.

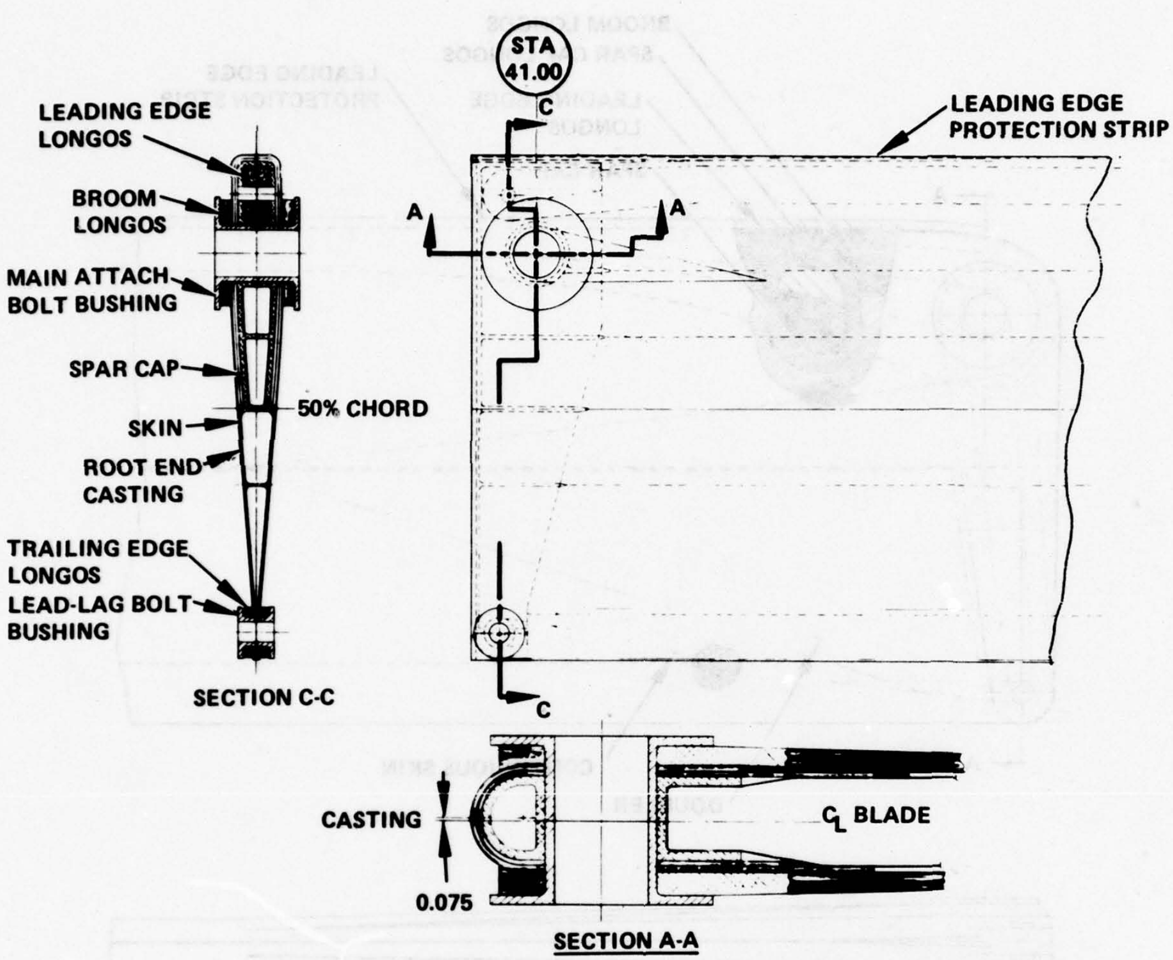


Figure 15. Blade root Configuration 4.

The root-end bushing chordwise stabilization is accomplished by a molded compression strut between the bushings and longo elements wrap around them to take tension loads.

Configuration 6 (Figures 11 and 17). Four filament-wound tubes form the MTS structure. A nonstructural leading edge weight provides chordwise balance. A spar longo is formed into two packs, one top and one bottom. They loop around the retention bolt bushing and fan out in the chordwise direction to cover the forward half of the blade chord. Additional broom longo material is added at the root end to perform the doubler function.

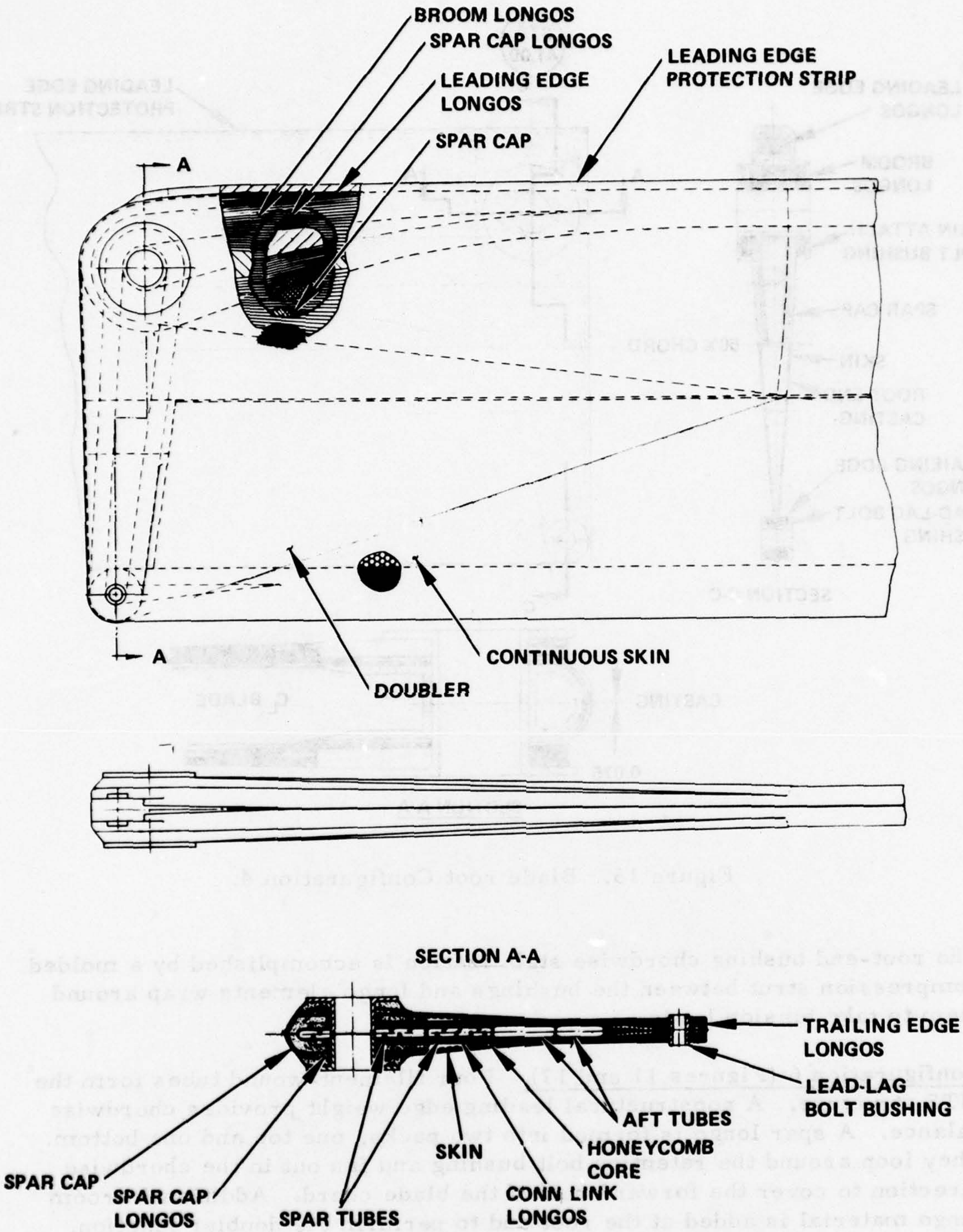


Figure 16. Blade root Configuration 5.

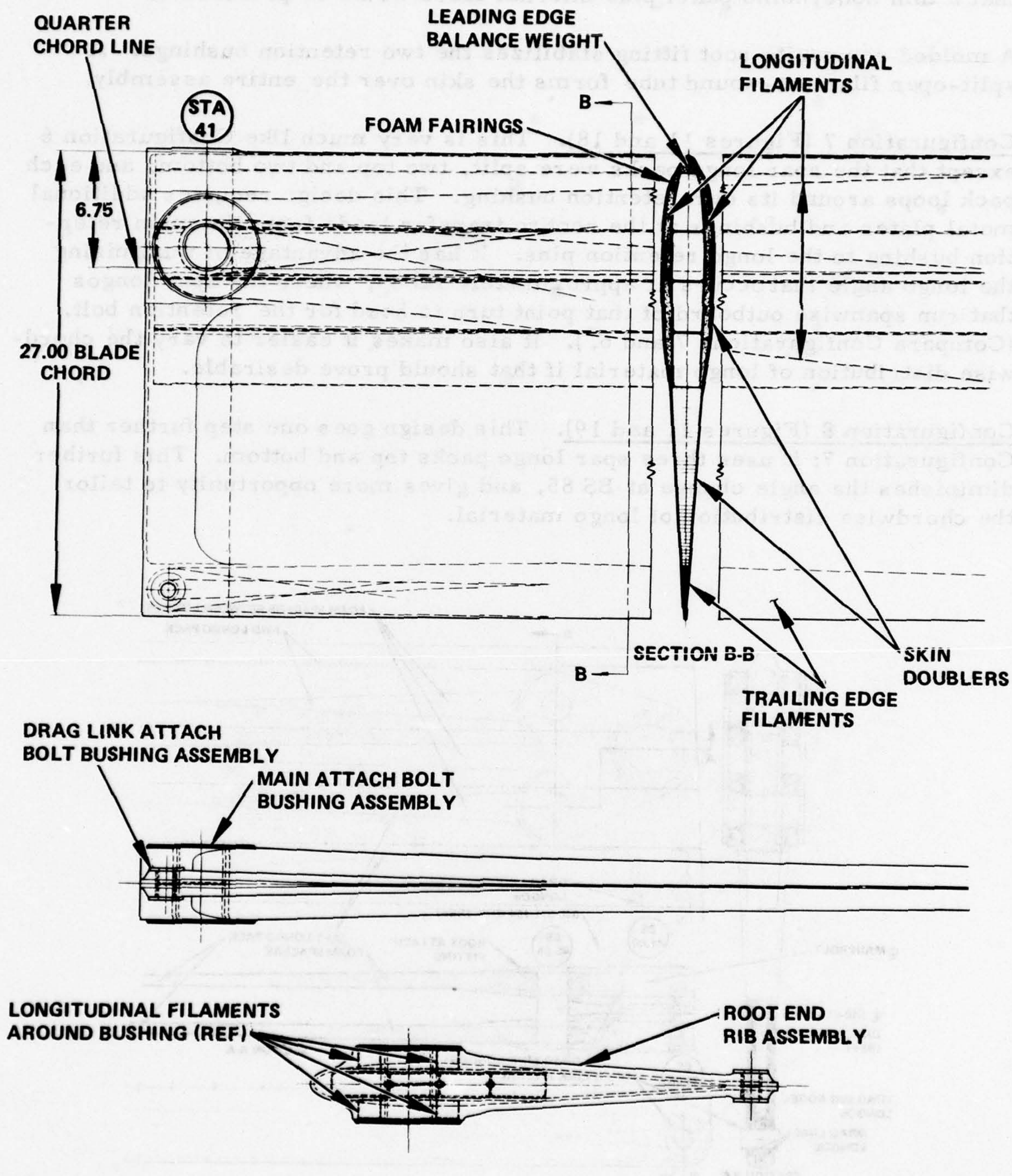


Figure 17. Blade root Configuration 6.

The trailing edge is shown to be solid honeycomb. Later studies indicated that a thin honeycomb panel plus internal tubes would be preferable.

A molded composite root fitting stabilizes the two retention bushings. A split-open filament-wound tube forms the skin over the entire assembly.

Configuration 7 (Figures 11 and 18). This is very much like Configuration 6 except that the spar longo packs were split, two top and two bottom, and each pack loops around its own retention bushing. This design requires additional metal plates and bushings at the root to transfer loads from the main retention bushing to the longo retention pins. It has the advantage of minimizing the longo angle that occurs at approximately BS 85, where the spar longos that run spanwise outboard of that point turn to head for the retention bolt. (Compare Configurations 7 and 6.). It also makes it easier to vary the chordwise distribution of longo material if that should prove desirable.

Configuration 8 (Figures 11 and 19). This design goes one step further than Configuration 7; it uses three spar longo packs top and bottom. This further diminishes the angle change at BS 85, and gives more opportunity to tailor the chordwise distribution of longo material.

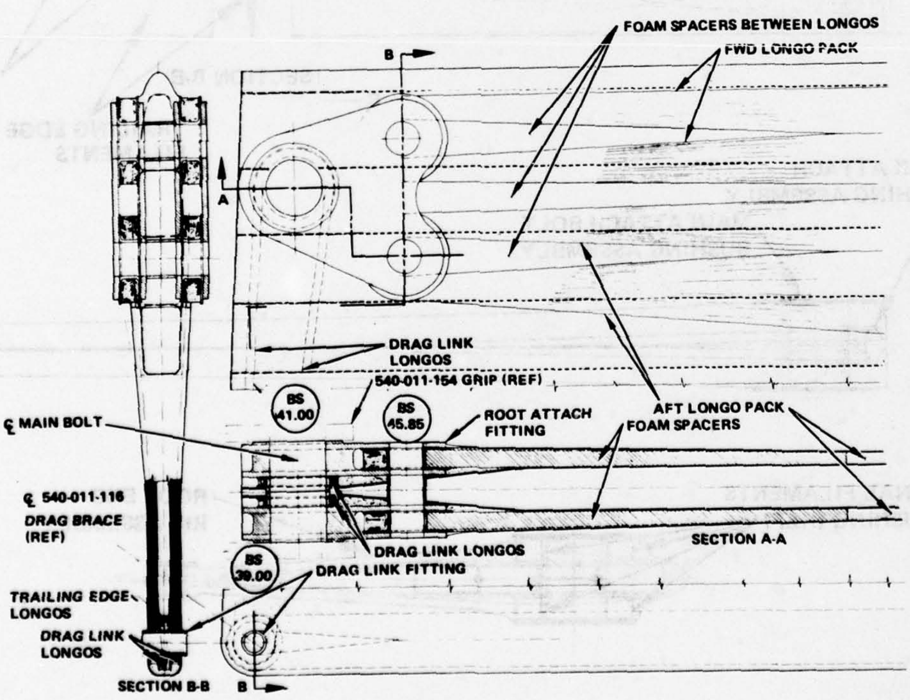


Figure 18. Blade root Configuration 7.

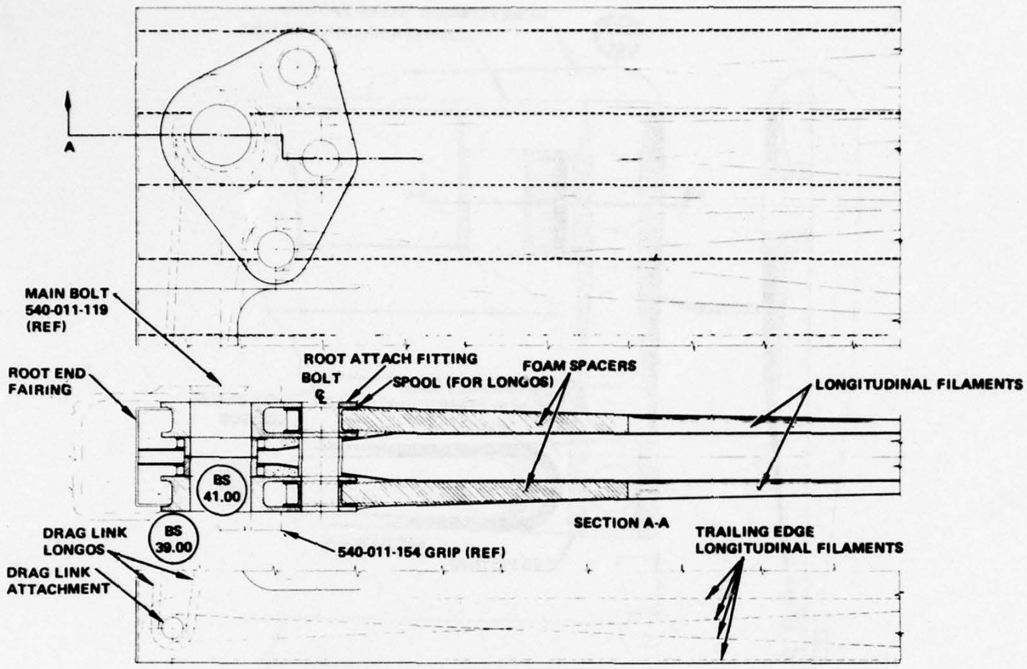


Figure 19. Blade root Configuration 8.

There is a small ballistic tolerance benefit near the blade root for Configurations 7 and 8, as opposed to Configuration 6, since the longos tie into multiple points.

<u>Configuration 9 (Figures 11 and 20).</u> The spar longo material is fabricated as three packs, each of which runs continuously from the blade tip, inboard around the root fitting, and back again to the tip. This arrangement allows chordwise tailorability of the longo material and avoids interruption of the longos in the region of the retention bolt bushing, as occurs in Configuration 4. A root-end metal forging is required to transfer loads from the longos into the retention bolt.

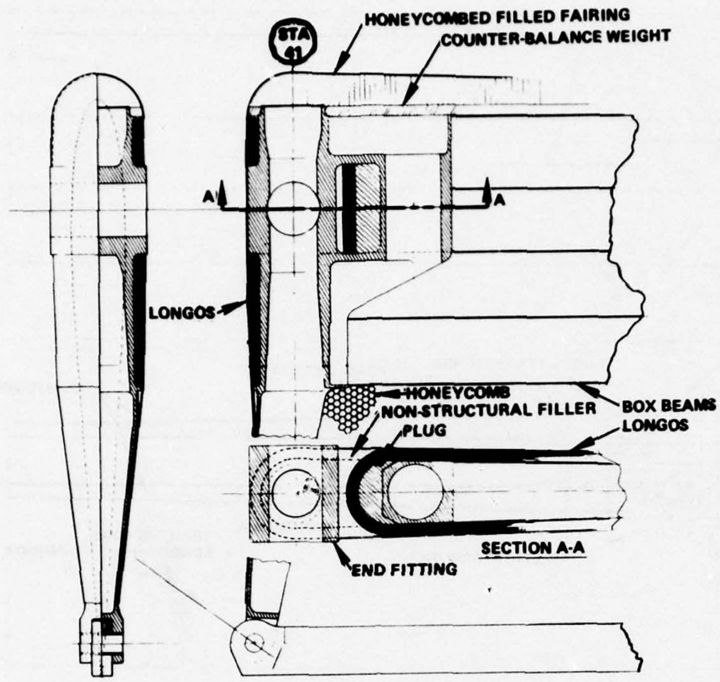


Figure 20. Blade root Configuration 9.

Blade Tip Configuration Descriptions

Configuration A (Figure 21). The four tip weights are distributed, one to each spar tube. The upper and lower contour of each weight is designed for a net fit within the blade structure. The outboard end of each weight is shaped much like the lip of a beverage bottle and forms part of the spar tube winding fixture, with the filaments wound around it to mechanically trap the weight among the fibers.

Each weight has a threaded hole through its length to accommodate adjustable weight elements. This feature is included in all depicted blade tip designs.

Configuration B (Figure 22). This configuration incorporates three wound-in weights as described for Configuration A. In addition, a contoured nose weight is pinned to the leading edge.

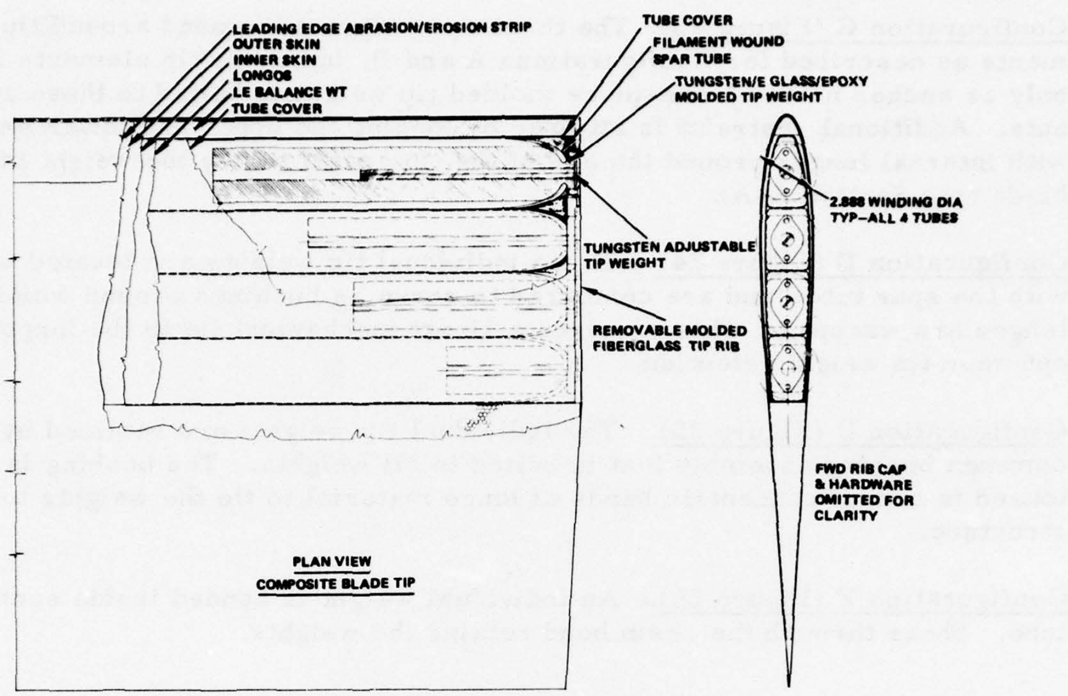


Figure 21. Blade tip Configuration A.

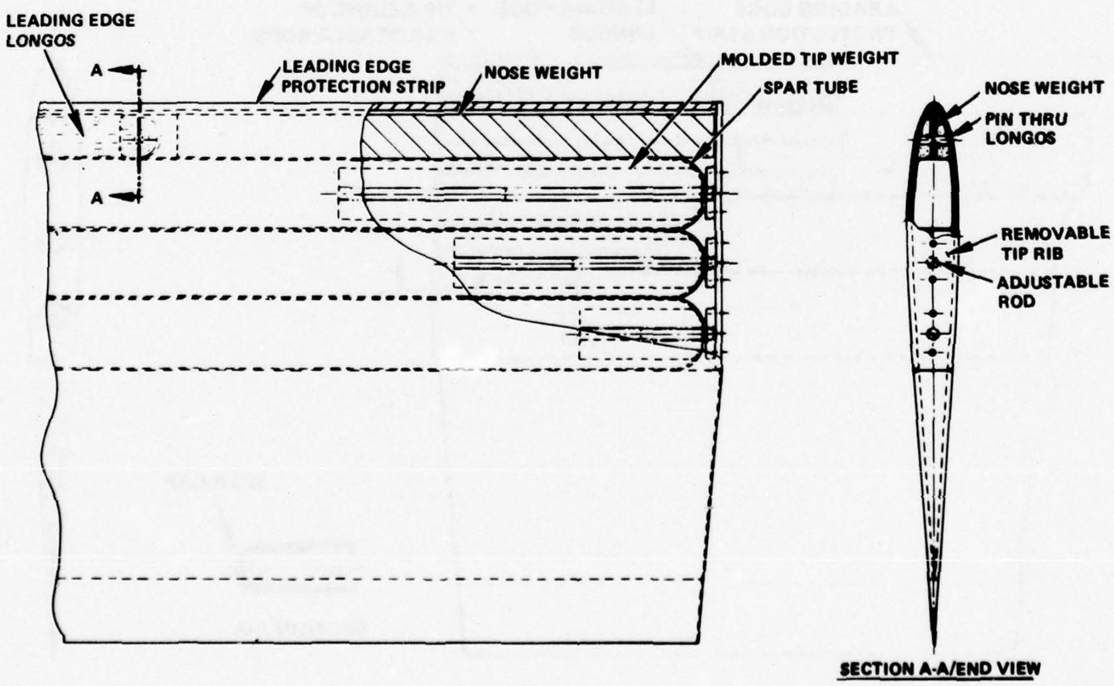


Figure 22. Blade tip Configuration B.

Configuration C (Figure 23). The three spar tubes are wound around tip elements as described for Configurations A and B, but these tip elements function only as anchor nuts. A one-piece molded tip weight is bolted to these anchor nuts. Additional restraint is attained by looping the upper and lower skin with internal longos around the end of the tip weight to key the weight into the blade (see Section A-A).

Configuration D (Figure 24). Three individual tip weights are located in line with the spar tubes and are contoured to serve as bushings around which the longos are wrapped. This provides a direct mechanical tie to the longos for optimum tip weight retention.

Configuration E (Figure 25). The individual tip weights are retained by a common bushing assembly that is bolted to all weights. The bushing is contoured to accept concentric bands of longo material to tie the weights to the structure.

Configuration F (Figure 26). An individual weight is bonded inside each spar tube. Shear through the resin bond retains the weights.

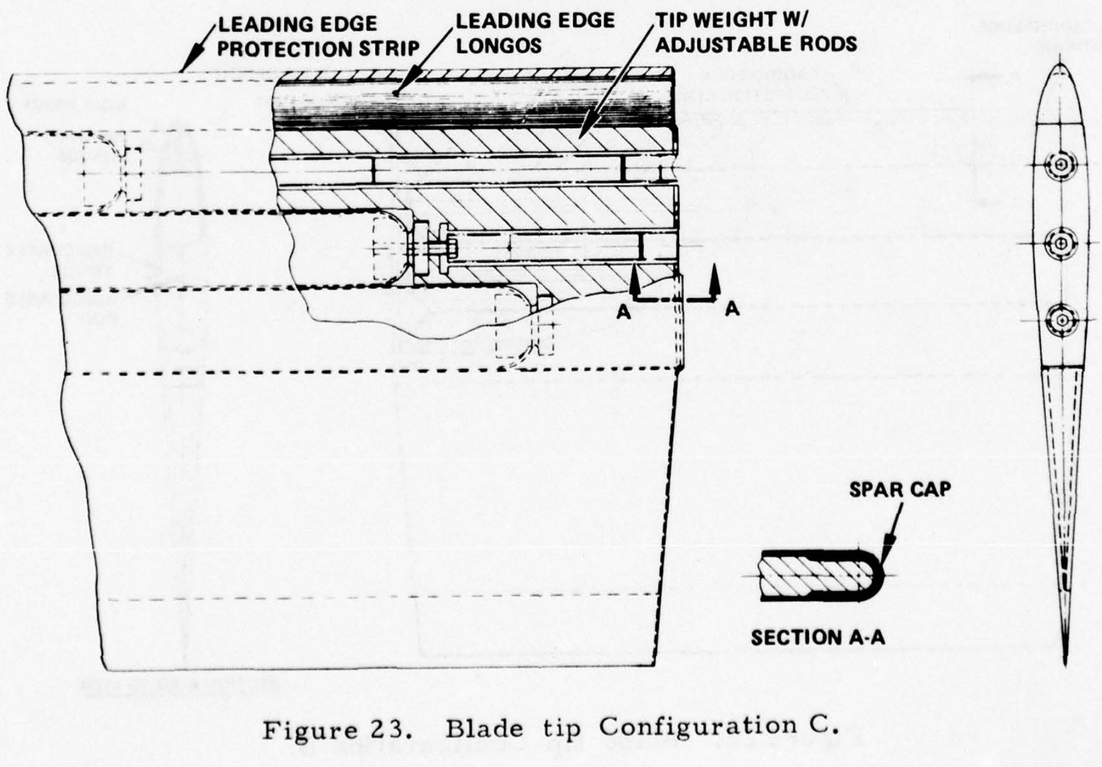


Figure 23. Blade tip Configuration C.

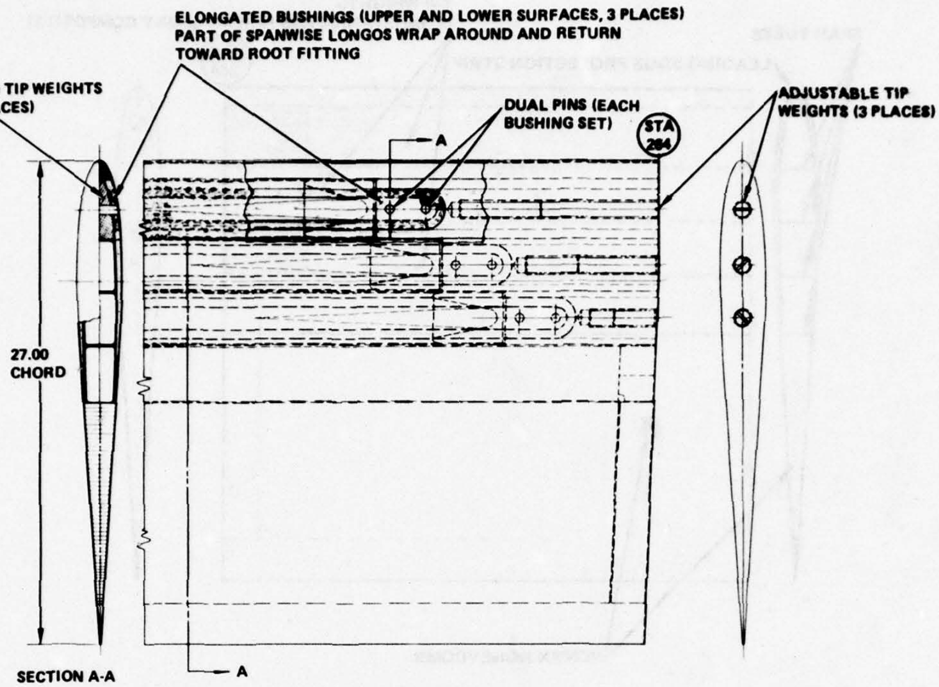


Figure 24. Blade tip Configuration D.

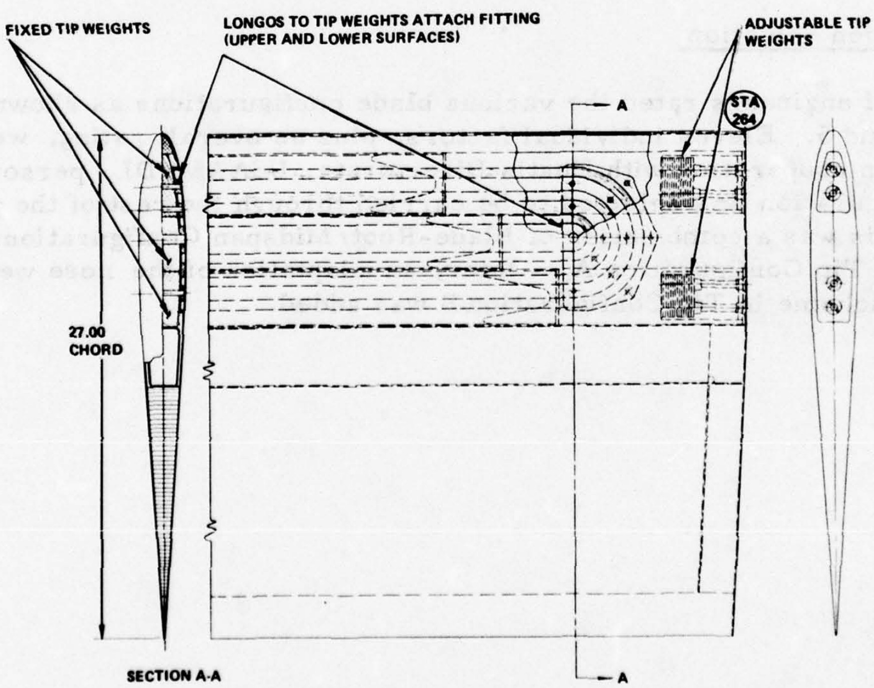


Figure 25. Blade tip Configuration E.

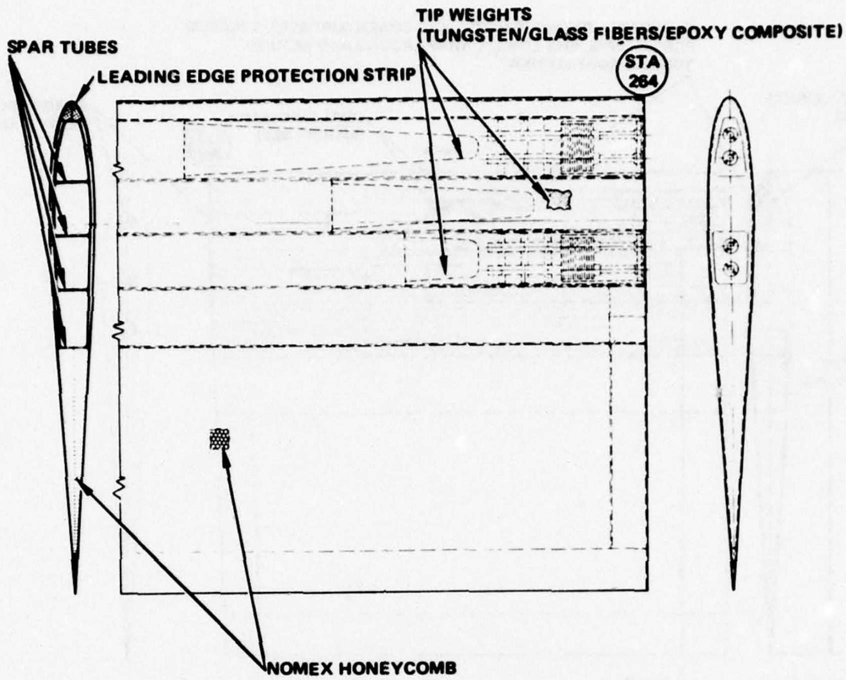


Figure 26. Blade tip Configuration F.

Configuration Selection

HH and FSI engineers rated the various blade configurations as shown in Tables 4 and 5. Eleven individual factors, plus an overall rating, were given to each. In cooperation with Eustis Directorate, USAAMRDL, personnel, a final configuration was selected to be carried through the rest of the program. This was a combination of Blade-Root/Midspan Configurations 1, 5, and 6, and Tip Configuration A -- later, an adaptation of the nose weight retention scheme in Tip Configuration B was added.

TABLE 4. BLADE ROOT CONFIGURATION RATING

	Configuration								
	1*	2	3	4	5*	6*	7	8	9
Structural Integrity	4	4	4	4	4	4	4	4	4
Low Cost	4	3	3	2	4	4	3	3	2
Ballistic Tolerance	1	4	4	3	4	3	3	3	4
Design Simplicity	4	3	3	3	3	3	3	3	3
Minimum Components	4	3	3	3	3	3	3	3	3
Development Risk	4	4	4	2	4	4	4	4	2
Radar Cross Section	4	4	4	4	4	4	4	4	4
Minimum Machining	4	4	4	2	4	4	3	3	2
Fits and Tolerance	4	4	4	3	4	4	3	3	3
Repairability	4	4	4	4	4	4	4	4	4
Fabrication Ease	4	3	3	2	3	3	3	3	2
Overall Rating	4	3	3	2	4	4	3	3	2

Excellent 4, Good 3, Fair 2, Poor 1

*Selected for integration into the final design.

TABLE 5. TIP CONFIGURATION RATING

	Configuration					
	A*	B*	C	D	E	F
Structural Integrity	3	3	4	4	4	2
Low Cost	4	3	2	2	2	2
Ballistic Tolerance	2	2	4	3	3	1
Design Simplicity	3	3	2	2	2	4
Minimum Components	3	3	2	2	4	4
Development Risk	4	3	4	3	3	3
Radar Cross Section	3	3	3	3	3	3
Minimum Machining	4	4	4	2	2	3
Fits and Tolerance	4	4	4	4	4	4
Repairability	2	2	2	2	2	2
Fabrication Ease	4	3	2	2	2	2
Overall Rating	4	4	3	2	2	1

Excellent 4, Good 3, Fair 2, Poor 1

*Selected for integration into the final design.

MANUFACTURING TECHNOLOGY DEVELOPMENT

The MTS blade contract specified that FSI was to be the subcontractor for fabricating the blade. This company had developed the WFW process through several military and commercial programs and had reached a rather high level of sophistication. The WFW process was ready to use in the MTS blade, except for a few manufacturing details. The contract allowed for improving the WFW and assembly processes, and included time and funds for building as many as three full-size toolproofing blades while refining the overall technique. It was later determined that only two toolproofing blades were needed.

The manufacturing technology development effort began with rather simple fabrication tests and culminated in building full-scale MTS blades for laboratory and flight testing.

The MTS blade design requires several WFW spar tubes which are wound with circular cross sections and then deformed in the blade mold into approximately trapezoidal shapes with straight, vertical walls where they intersect. It was thought that this would happen automatically but, nevertheless, tests were made in which round tubes were placed into a mold and pressurized. In the first test, four thin-walled polyethylene tubes were inflated inside a rectangular box (Figure 27, top). Then WFW fiberglass tubes were inflated inside a mold and the tubes were cured (Figure 27, bottom). The tube intersections were straight and vertical, giving assurance of success for the actual blade.

The tip weight design calls for metal tip weights to be wound into two of the spar tubes. Again, the tubes are wound round and then forced into a trapezoidal shape in the blade mold. The tip weight has a trapezoidal cross section the same as the finished tube, and a circular neck into which the filaments are wound for mechanical entrapment. A tip weight was simulated by a wooden block and a tube was wound around it; then the tube was forced into a rectangular shape, and cured (Figure 28). This procedure was judged satisfactory.

These activities were followed by making a full-size fiberglass shell-type blade mold with proper chord and airfoil section, but only 4 feet long and with no twist (Figure 29). Two blade specimens were assembled and cured to evaluate the fabrication technique. The process was straightforward and gave confidence for proceeding with construction of the complete blade. One of these 4-foot specimens was ballistically tested against 23mm HEI-T projectiles. The ballistic test proved the rip-stopping function of the interwound filaments but showed that a plastic film material, used as a vacuum

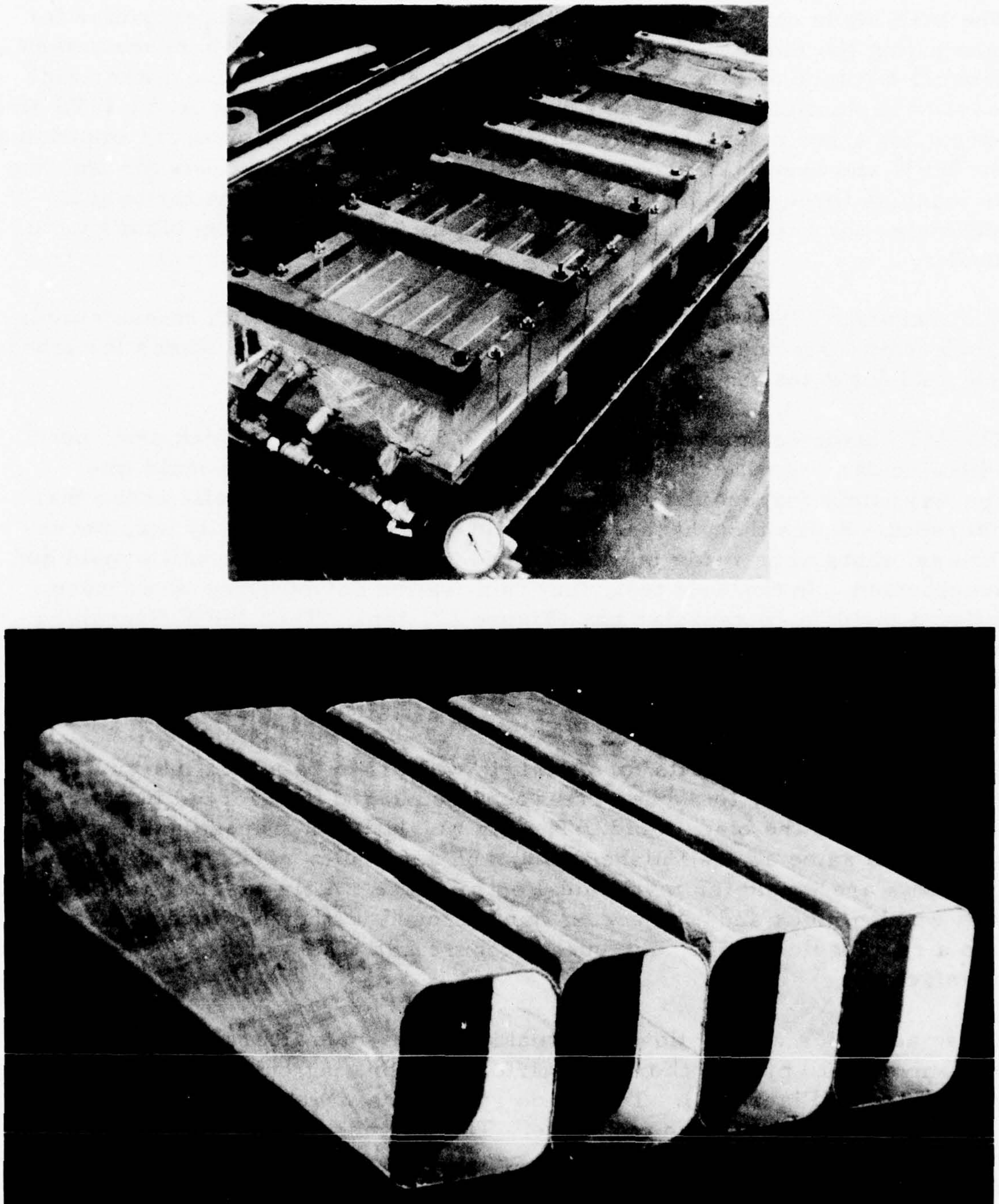


Figure 27. Spar tube technology demonstration.

diaphragm in the blade as a manufacturing aid, could not withstand ballistic shock loads. This finding led to a search that culminated in the selection of a film adhesive material held in a nylon matte carrier. It bonded well to the other materials in the blade and served satisfactorily as a vacuum diaphragm to hold the blade components in place in the mold.

Three manufacturing trials were made to establish methods for fabricating the spar cap which is a flattened, thick-walled tube. The first was a simple test that consisted of winding a short length of Kevlar-49 tube having a 0.072-inch-thick wall, and then flattening it to demonstrate that it could be compressed without wrinkling. The second test combined longos into the spar cap by winding two layers of helical filaments, laying on the longos, completing the helical wraps, and then flattening the tube. Both trials were satisfactory but the combined longo/helical tube design was discarded in favor of a design that wound each component separately. The third trial was for the purpose of winding the spar cap tube on a film adhesive mandrel, removing the film backing, and flattening the tube. The method that evolved and was used to build the spar caps for the blades required a solid metal mandrel with a close-fitting, inflated cover made from polyethylene film. That film was covered with adhesive film that had its backing sheet against the polyethylene. After the wet Kevlar filaments were wound over the adhesive film, the metal mandrel, polyethylene bag, and adhesive backing sheet were pulled out and the tube was easily flattened.

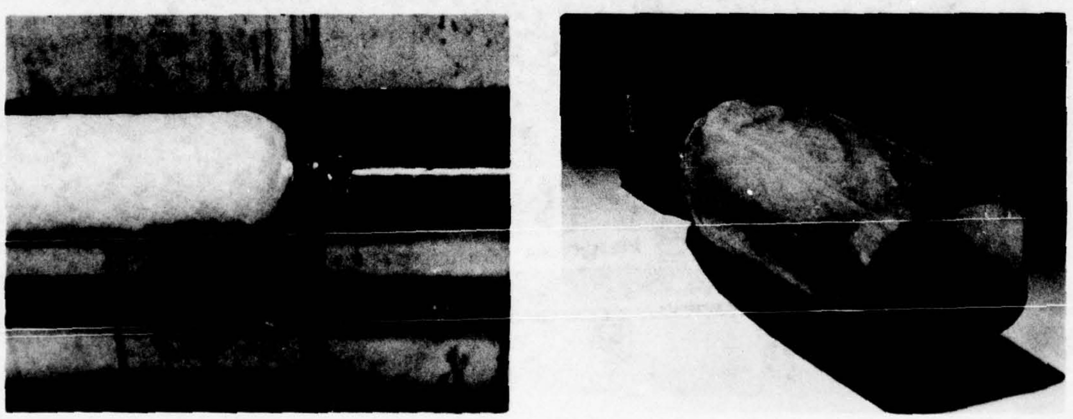


Figure 28. Spar tube tip weight technology demonstration.

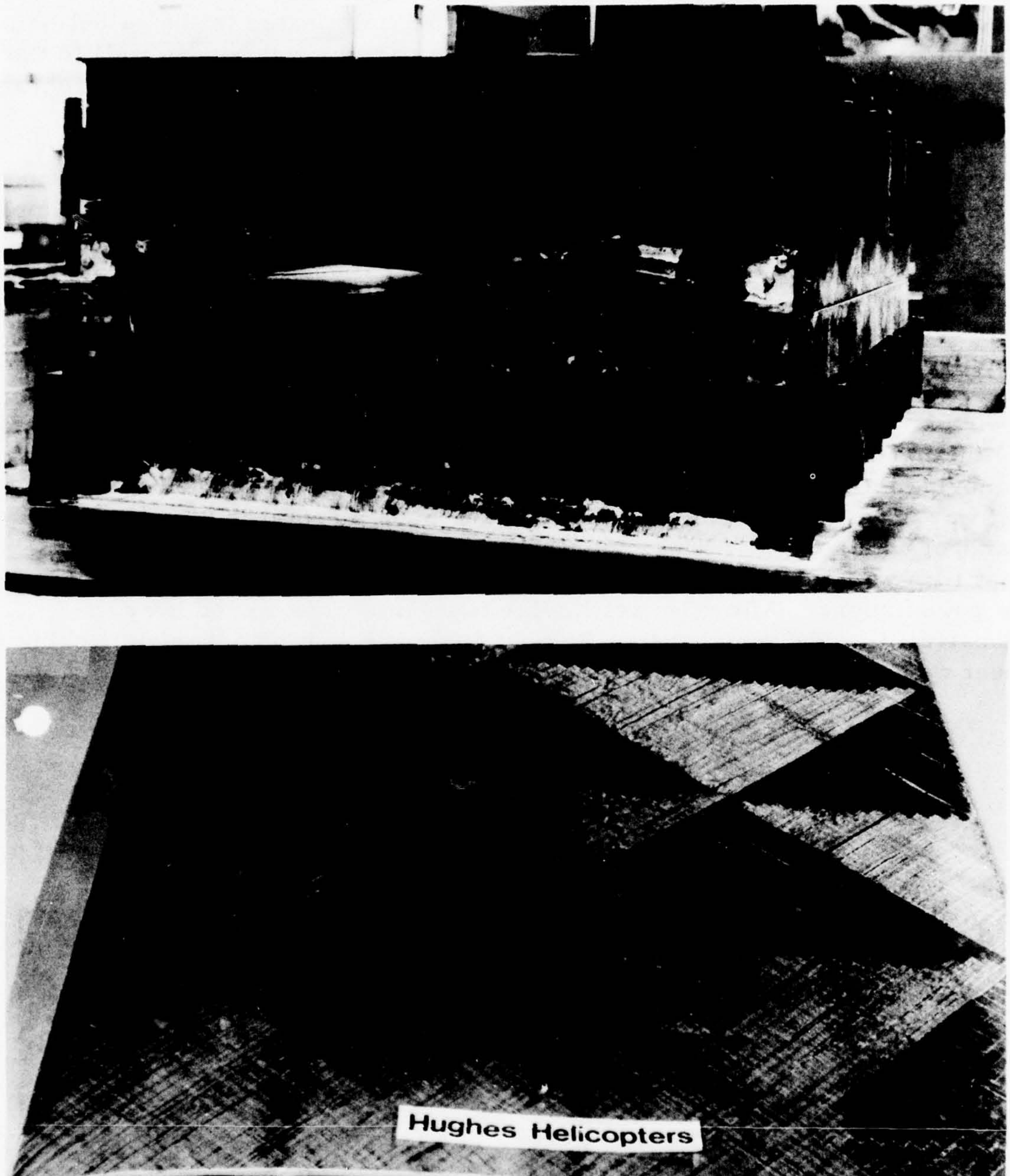


Figure 29. Four-foot mold and blade for co-cure process development.

The full-scale blade mold, which is shown open in Figure 30 and closed in Figure 31, was built to the contour of the 540 metal blade outboard of BS 85. Inboard of BS 85 the contour was altered to accommodate the root features of the MTS blade. This mold is a two-piece fiberglass shell that has two layers of graphite cloth molded into each mold half to serve as integral electric heaters. The shells are backed by square fiberglass tubes that distribute the mold pressure loads to a steel backup structure and minimize differential thermal stresses. Recesses formed into the mold surfaces serve to locate the metal blade root bushings and leading edge tip weight. Long threaded rods clamp the two mold halves together for curing the blade. Notched indexing plates at each end of the mold (Figure 32) align the spar tubes.

Two full-scale toolproofing blades (Figure 33), designated "A" and "B", were built to check out the procedure. These were complete in all aspects, except that "A" had wooden tip weights, and both "A" and "B" had aluminum blade root bushings. These blades showed up several factors in the production process that needed improvement including:

a. Resin control

b. Winding tension

c. Spar tube diameter control

d. Orientation of longo filaments

e. Weight control

f. Center of gravity location

g. Pressure leaks during cure

h. Spar tube location

i. Blade surface treatment

j. Vacuum diaphragm

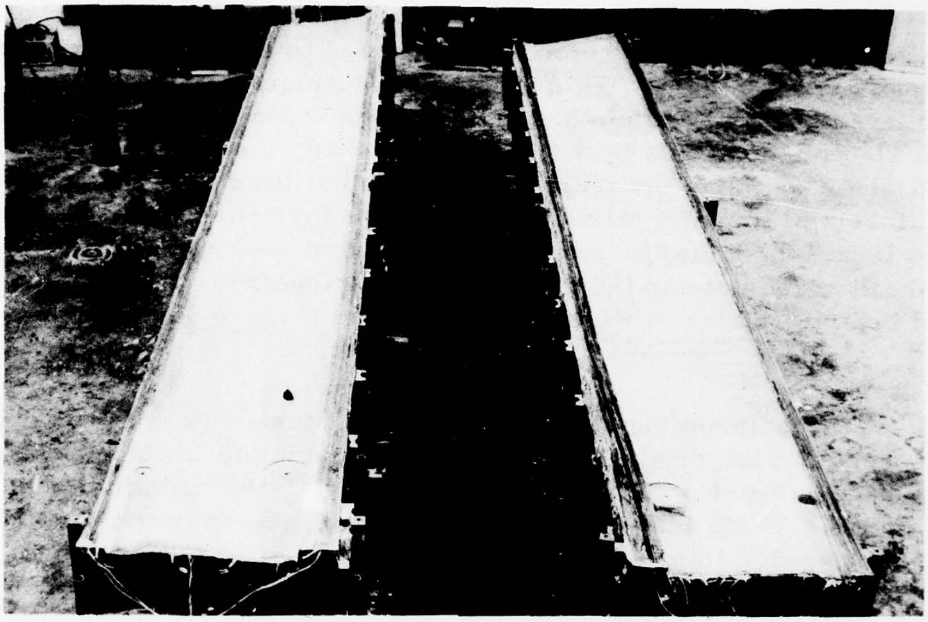


Figure 30. Open blade mold.

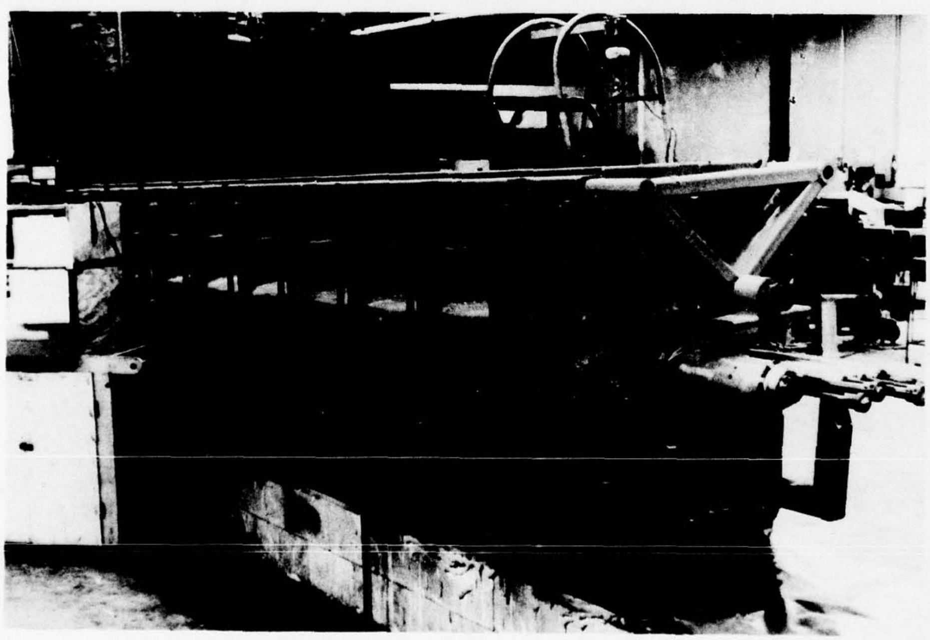


Figure 31. MTS blade mold.

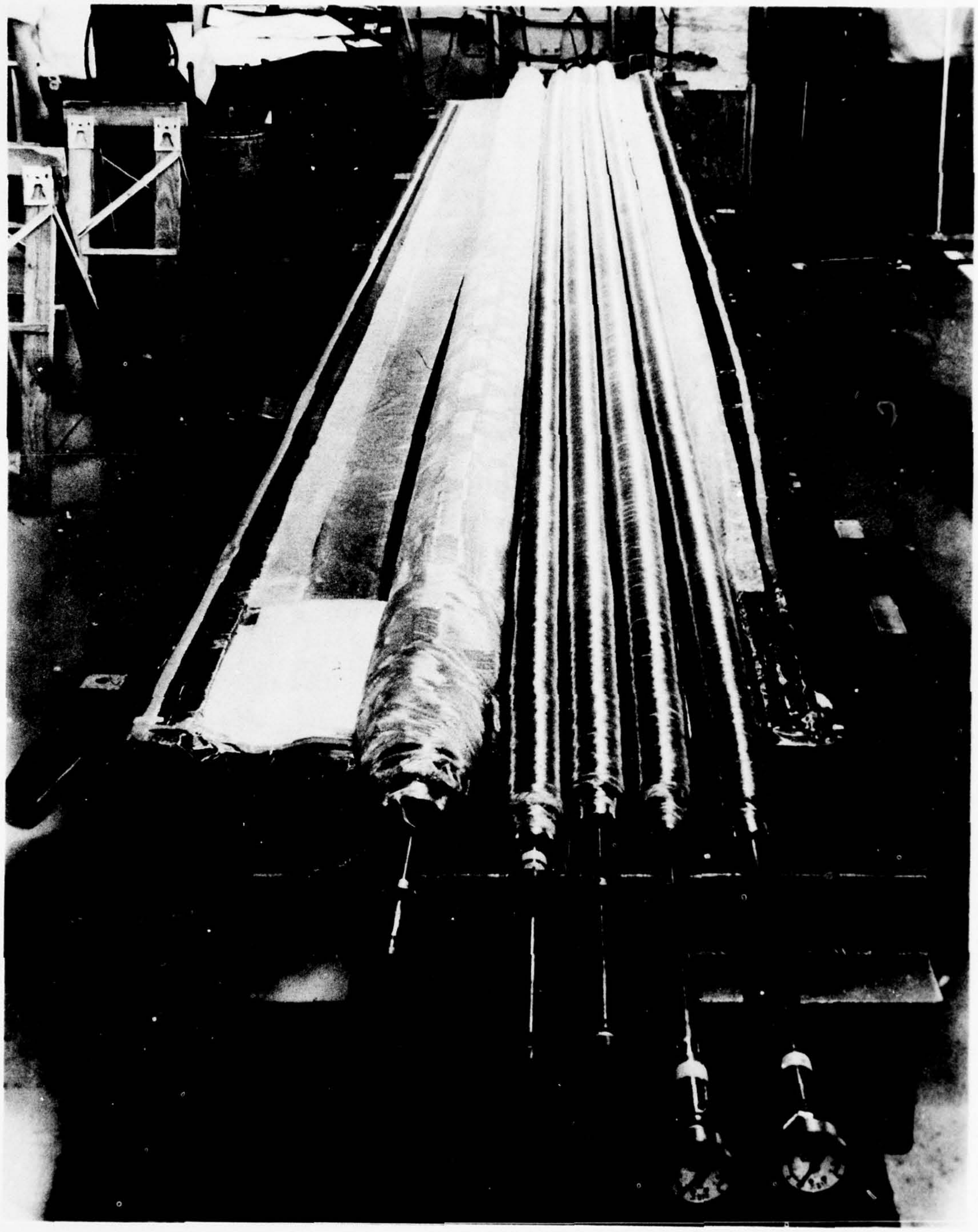


Figure 32. Blade mold indexing fixtures.

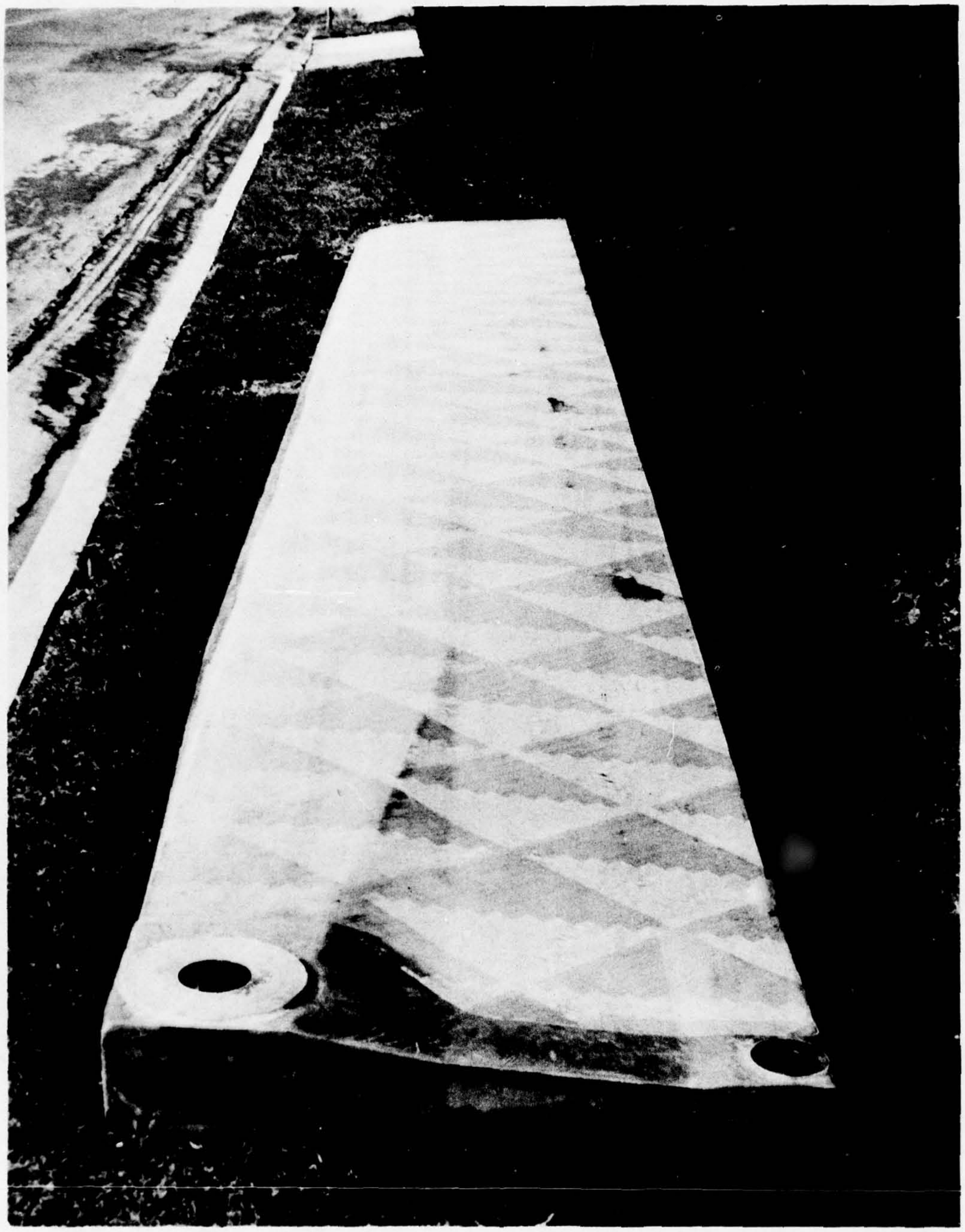


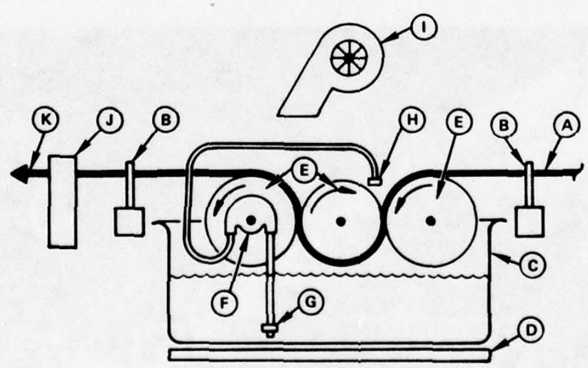
Figure 33. MTS toolproofing blade.

Resin Control and Winding Tension

The first two problem areas were interrelated. The WFW process leads dry filaments from spools through a resin impregnator (Figure 34) that thoroughly wets the filaments with a metered amount of resin, and delivers them in a uniform band to the component being wound. This band must be delivered with low tension in it. The dry filament rovings pass through a comb that keeps them aligned, and then between three heated rollers. From the rollers they go through another comb and through the winding eye. A systolic pump, driven by the final roller, pumps warmed resin onto the dry filaments as they pass over the rollers.

The resin is held at constant temperature to keep it at uniform viscosity. The rollers themselves are heated to aid in making the resin flow into each filament roving to thoroughly impregnate it. The winding eye collects the individual rovings, aligns them side-by-side in a uniform band, and dispenses them to be wound as tubular elements or longos.

The power to operate the impregnator comes from the machine that winds the blade components. It pulls the filaments through the impregnator, which turns the rollers; they, in turn, force resin into the rovings. This device requires a 4- to 6-pound tension in a 15-roving band; that force is compatible with winding the filament on the inflated plastic mandrels used in making the MTS blade.



A. DRY ROVING BAND FROM SPOOLS OF FILAMENTS
B. COMB TO ALIGN FILAMENTS
C. RESIN RESERVOIR
D. RESERVOIR HEATER
E. IMPREGNATION ROLLER (3)
F. SYSTOLIC PUMP
G. PUMP INLET WITH METERING ORIFICE
H. RESIN DISPENSING OUTLET
I. HOT AIR BLOWER
J. WINDING EYE TO ALIGN FILAMENTS
K. WET FILAMENT BAND TO WINDING MACHINE (4 TO 6 POUNDS TENSION)

Figure 34. Resin impregnator.

This impregnator maintains a constant ratio of resin weight to filament weight. It must be adjusted for the number of rovings being impregnated and the speed at which the filaments are drawn through it. An adjustable orifice in the pump's suction line meters the amount of resin being delivered. Resin impregnation is calibrated by first weighing a 60-foot-long band of dry rovings, and then weighing an equal-length band of wet rovings dispensed at the speed to be used in the WFW process. The orifice is adjusted until the dry- to wet-filament weight ratio is the specified value. As a further weight control measure, the winding mandrel is weighed before and after the winding process. The differential weight is compared with the calculated weight of the wound part (including the excess material that must be wound beyond each end of the actual part length). Agreement within ±3 percent is maintained.

Spar Tube Dimensional Control

Spar tube dimensional control is achieved by using the bladder fabrication tool shown in Figure 35. This takes a Tedlar film sheet, folds it, and bonds the edges to make a bladder whose circumference is precisely held. When the bladder is placed on the winding machine (Figure 36) its diameter is measured at several stations along its length to make sure it is within tolerance. After the tube is wound, the diameter is again measured for tolerance control.

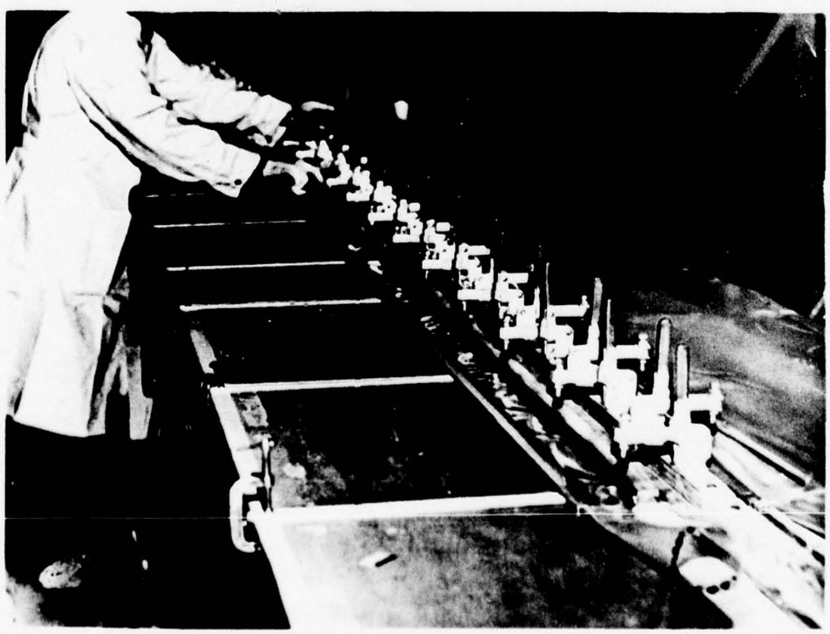


Figure 35. Bladder fabrication fixture.

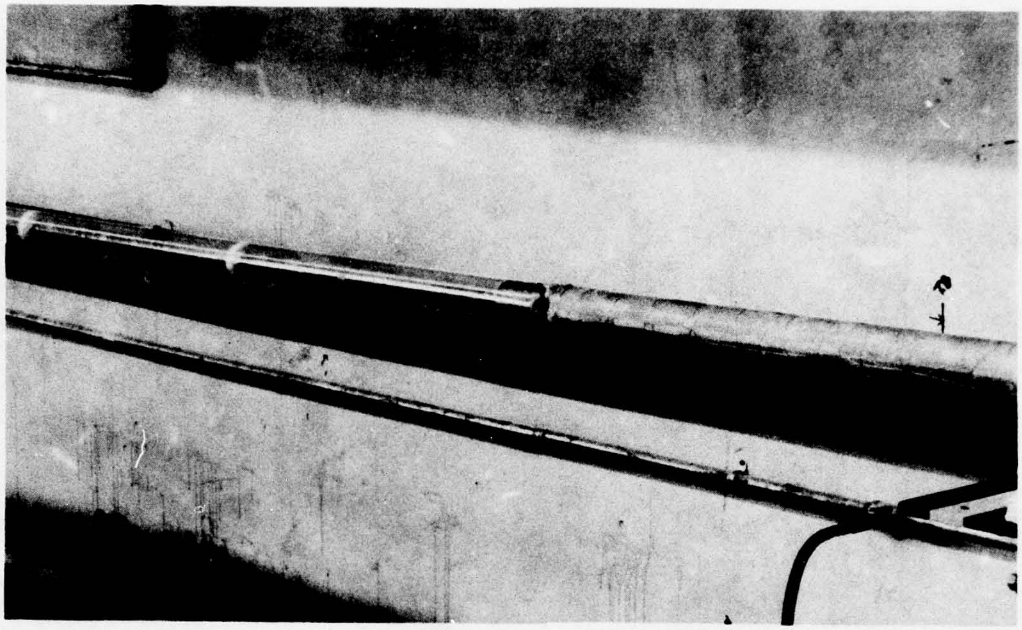


Figure 36. Inflated bladder for spar tube winding.

Orientation of Longo Filaments

Longo filament orientation was solved by the longo winding fixture shown in Figures 37 and 38. It has a hardback (one for each longo) pinned to the top of a rotating table which turns like a merry-go-round, at about 3 rpm. The fixture winds longos by pulling the rovings through the table-mounted resin impregnator seen in the background of Figure 37 and in the foreground of Figure 38, and wrapping them around pins at the ends of the hardbacks.

A fiberglass tray, seen at the far end of the hardback in Figure 37 and at the near end in Figure 38, is mounted on the hardback and the filaments are wound into it. The tray keeps the filaments straight at the crucial root end of the longo, aids in removing the longo from the hardback, and helps align the longo in the blade mold.

The longos are wound either directly on the stainless steel blade root bushing (spar longo and trailing edge longo) or on a sleeve portion of a fiberglass tray that slips over the bushing (broom and leading edge longo) and is bonded to it. In this manner, the filaments are never disturbed between the time they are wound and when they are placed in the mold. Special guides on the winding

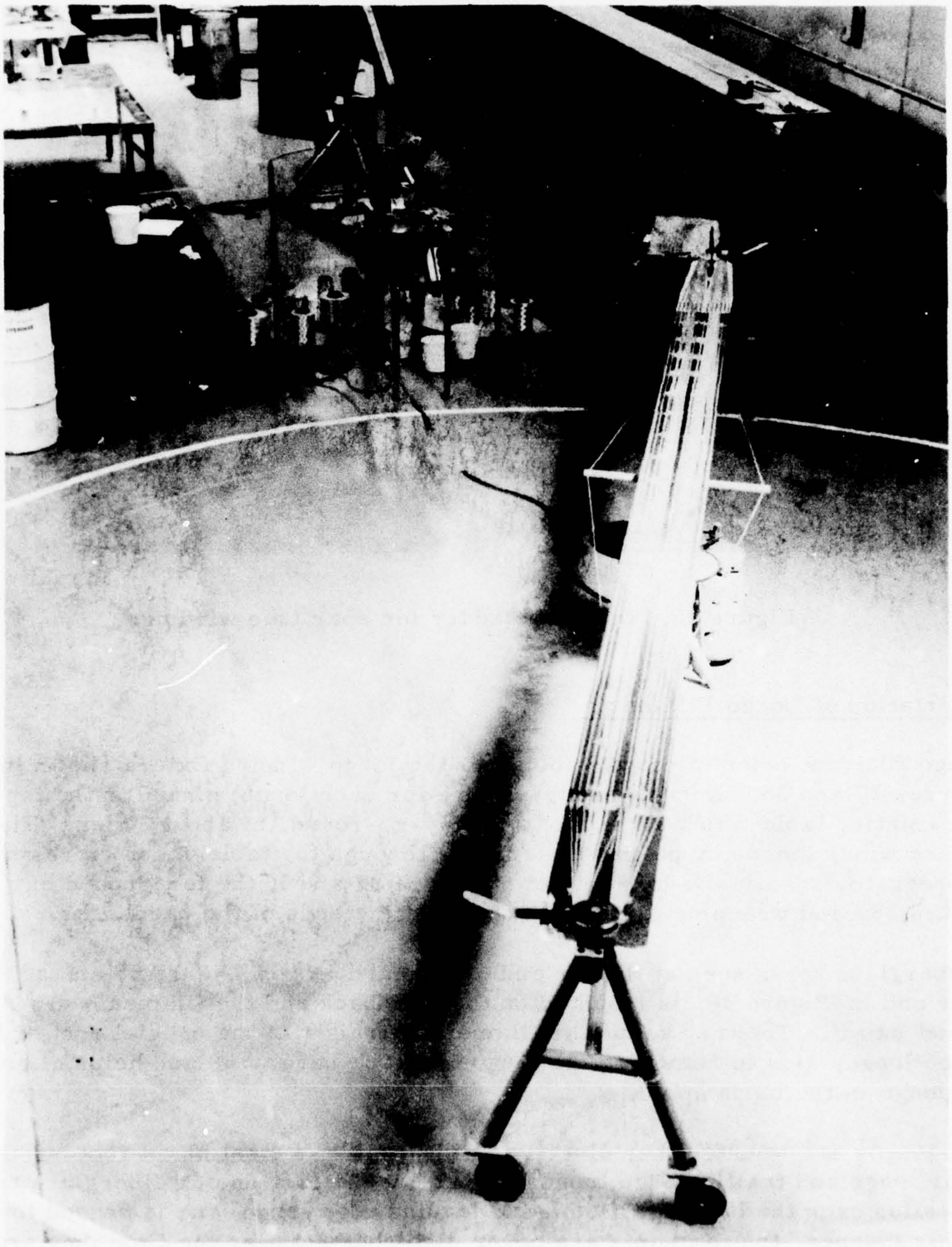


Figure 37. Longo winding fixture.

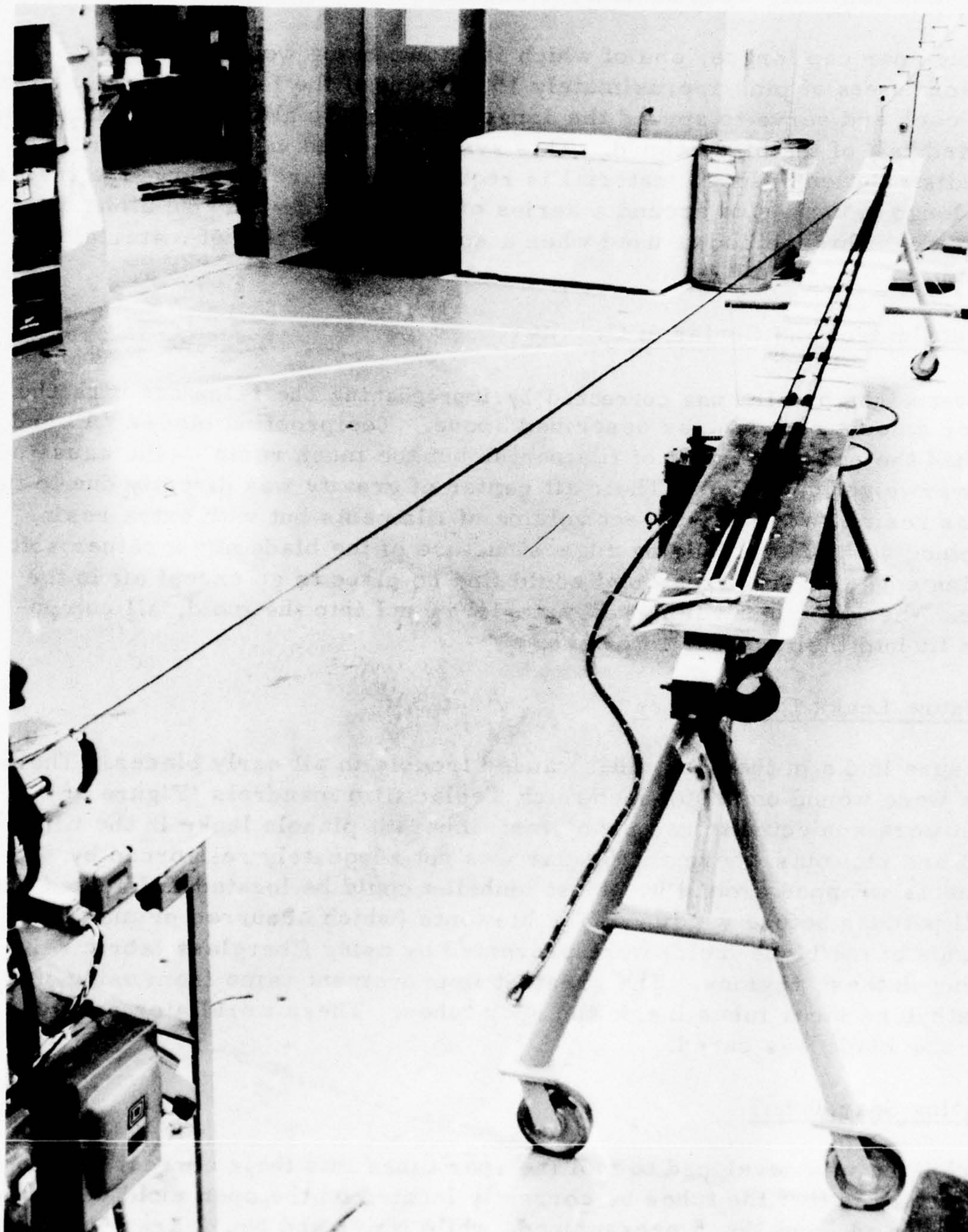


Figure 38. Trailing edge longo being wound.

fixture maintain the correct thickness of the longo pack in this critical area where the filaments wrap around the bushing.

For the spar cap longos, one of which is shown being wound in Figure 37, additional sets of pins approximately 15 percent of the length of the longo in from each end serve to spread the longo filaments to allow them to cover the forward half of the blade chord. This system is used where uniform spanwise distribution of longo material is required. Figure 38 shows the trailing edge longo being wound around a series of pins placed spanwise along the hardback. This method is used when a spanwise variation of material is needed.

Weight Control and Center of Gravity

The overweight problem was corrected by impregnating the filaments with the proper amount of resin, as described above. Toolproofing blades "A" and "B" had the proper amount of filaments, but too much resin -- the cause of the overweight condition. Their aft center of gravity was directly due to the excess resin. With the correct volume of filaments but with extra resin, combined with a solid leading edge structure of the blade and a rather soft trailing edge, the spar material could find no place to go except aft in the blade. When the right volume of material is put into the mold, all components fit into their proper locations.

Pressure Leaks During Cure

Pressure leaks in the spar tubes caused trouble in all early blades. These tubes were wound on 0.001-inch-thick Tedlar film mandrels (Figure 36) which were subjected to two problems: inherent pinhole leaks in the film itself and blowouts where the Tedlar was not adequately reinforced by filaments wrapped around it. Most pinholes could be located and sealed with small patches before winding. The blowouts (which occurred primarily at the ends of the blade mold) were prevented by using fiberglass fabric reinforcing in these regions. The greatest improvement came from using polyethylene inner tubes inside the spar tubes. These were later removed after the blade was cured.

Locating Spar Tubes

A technique was developed to tool the spar tubes into their correct locations. This requires that the tubes be correctly located on the open mold with tubes No. 3, No. 4, and No. 5 pressurized, while No. 1 and No. 2 are put in place deflated. All tubes are deflated while the mold is being closed. Then No. 4 is pressurized to lock the others in place. Tube No. 3 is pressurized next, followed by No. 1, No. 2, and No. 5 which are pressurized simultaneously.

Blade Surface Treatment

A blade surface treatment investigation was directed toward using Tedlar film as the outside surface of the blade skin. It was shown to be generally compatible with the blade fabrication process, but needed more development to perfect the process than could be accommodated in the present program. It is highly recommended that this process be developed for future blades because the Tedlar acts as a mold release, seals the blade against moisture, is an ultraviolet barrier to protect the resin, and comes in colors so that painting is not necessary.

Leading edge erosion protection material was selected from a radar reduction/leading edge erosion program, Reference 1.

Vacuum Diaphragm

The blade assembly technique requires that half of the blade material be placed in the top half of the mold, and half in the bottom. Then the top half-mold is turned over (with its blade material still in place) and positioned on the lower mold. To hold the WFW components on the upper mold while it is being turned upside down, a bondable vacuum diaphragm is used. This diaphragm must be impervious enough to maintain sufficient vacuum to prevent the WFW components from falling off the mold surface, and must be bondable to the WFW elements because it must remain in the blade. Several types of diaphragm material were investigated before Fiber Resin Corporation's FR-7035 film adhesive in a nylon matte carrier was chosen.

Radar-Absorbing Material

The technology related to incorporating radar-absorbing material, Reference 2, is discussed in Volume III.

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1. Head, R. E., EROSION PROTECTION FOR THE AH-1G LOW RADAR CROSS-SECTION MAIN ROTOR BLADE, VOLUME I - SAND AND RAIN EROSION EVALUATION, Hughes Helicopters, Division of Summa Corporation; USAAMRDL Technical Report 76-40A, Eustis Directorate, U. S. Army Air Mobility Research and Development Laboratory, Fort Eustis, Virginia, January 1977, AD A035961.
2. Head, R. E., EROSION PROTECTION FOR THE AH-1G LOW RADAR CROSS SECTION MAIN ROTOR BLADE, VOLUME II - RADAR CROSS SECTION EVALUATION (U), Hughes Helicopters, Division of Summa Corporation; USAAMRDL Technical Report 76-40B, Eustis Directorate, U. S. Army Air Mobility Research and Development Laboratory, Fort Eustis, Virginia, January 1977 (S), AD C009381L.

SECTION II – DETAIL DESIGN

This section describes the detail design and analysis of the MTS blade. The candidate configurations designated during the preliminary design effort for integration were brought together in this phase into the final detail design of the blade. Throughout this process, close liaison was maintained between the tool designers and WFW manufacturing engineers to achieve optimum design/manufacturing integration. As a result, the MTS blade is a reliable structure that meets all the objectives set out for it at the beginning of the program.

DESCRIPTION OF THE MTS BLADE

The final MTS blade design details are shown in Figures 39 through 46. The blade has a 27-inch chord, a 226.5-inch span (BS 37.5 to BS 264.0), a linear twist of 0.45 degree per foot, and mounts interchangeably on the 540 hub of the AH-1G helicopter. The design of the blade can best be described by starting at its outside contour and working in. The description given here is in general terms. The MTS blade Process Specification in Volume II details the process of assembly.

The geometry of the blade is symmetrical, top and bottom. The internal structure is also symmetrical except for one feature which will be described below. The multi-tubular spar occupies the forward half of the chord, and the trailing edge structure occupies the rear half. The spar structure extends this far aft to disperse the structural elements and make them more tolerant of the 23mm HEI-T threat. The blade is covered by a three-ply Kevlar-49 skin, which is 0.018 inch thick and consists of a ±45-degree layer and a single 90-degree layer (see the angle nomenclature in Figure 2). The skin provides a portion of the blade torsion stiffness and a shear tie to the trailing edge longo.

The upper and lower spar longos are two packs of unidirectional Kevlar-49 filaments, each of which is continuous from the blade tip, runs inboard around the main bushing where the blade attaches to the hub, and back outboard to the tip. The spar longos are the primary members that provide flapwise stiffness; each spar longo in combination with its spar cap is independently capable of carrying all the centrifugal force in the blade. Outboard of BS 85, the spar longo is a band of filaments 11.75 inches wide and 0.044 inch deep. At the bushing this pack is 0.29 inch deep and 1.78 inches wide. At the inboard end where the bushing is located, the longo is wound into a preformed fiberglass tray that acts both as a guide for the filaments

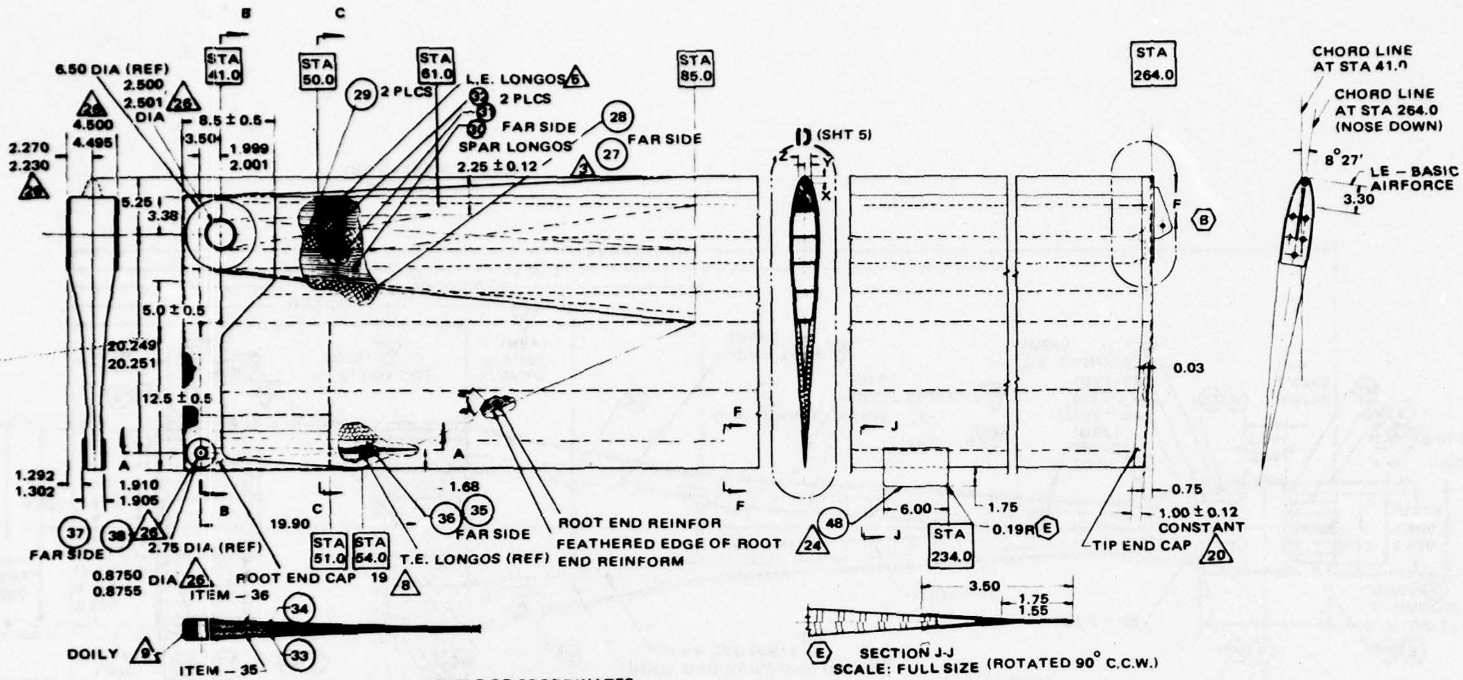


TABLE OF COORDINATES

X	Y	Z						
			0.630	0.596	1.193	2.940	1.100	2.201
0.027	0.130	0.260	0.738	0.638	1.277	3.360	1.142	2.285
0.053	0.183	0.365	0.840	0.678	1.347	4.200	1.205	2.411
0.105	0.256	0.512	1.050	0.746	1.491	5.250	1.247	2.495
0.210	0.357	0.714	1.260	0.806	1.613	6.300	1.260	2.520
0.263	0.397	0.794	1.470	0.859	1.718	8.400	1.218	2.436
0.315	0.433	0.865	1.785	0.926	1.852	10.773	1.094	2.188
0.420	0.496	0.991	2.100	0.983	1.966	27.000	0.027	0.055
0.525	0.548	1.096	2.520	1.048	2.096	L.E. RADIUS = 0.332		

Figur.: 39. MTS blade planform.

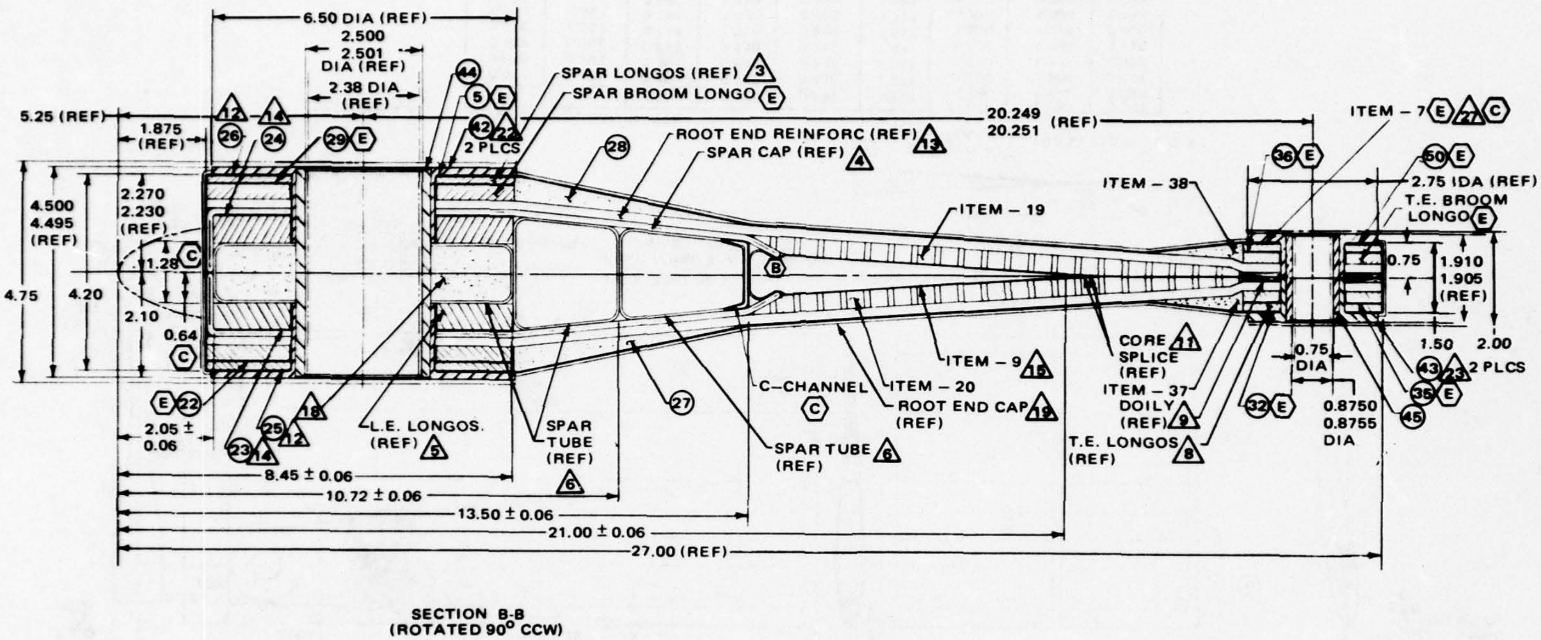


Figure 40. MTS blade section – BS 41.

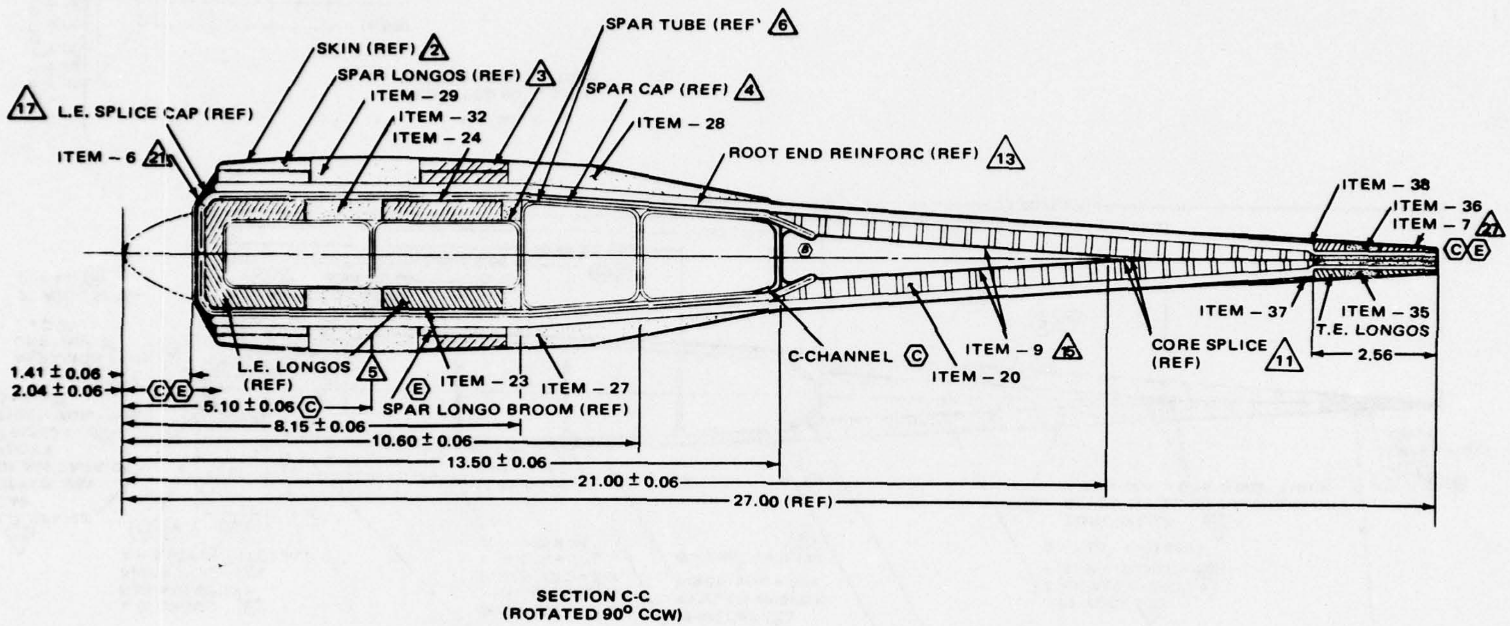


Figure 41. MTS blade section – BS 50.

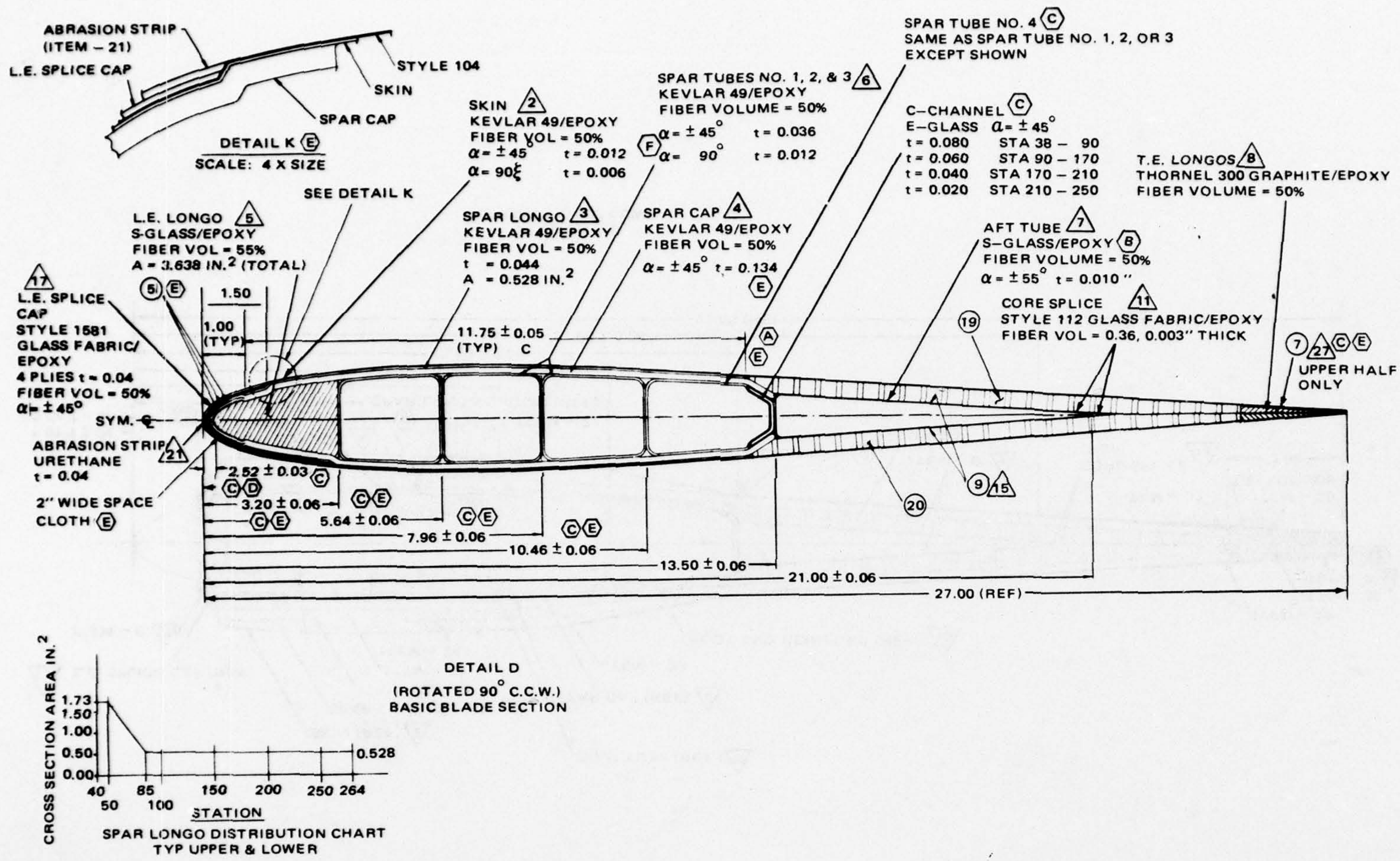


Figure 42. MTS blade section – BS 200.

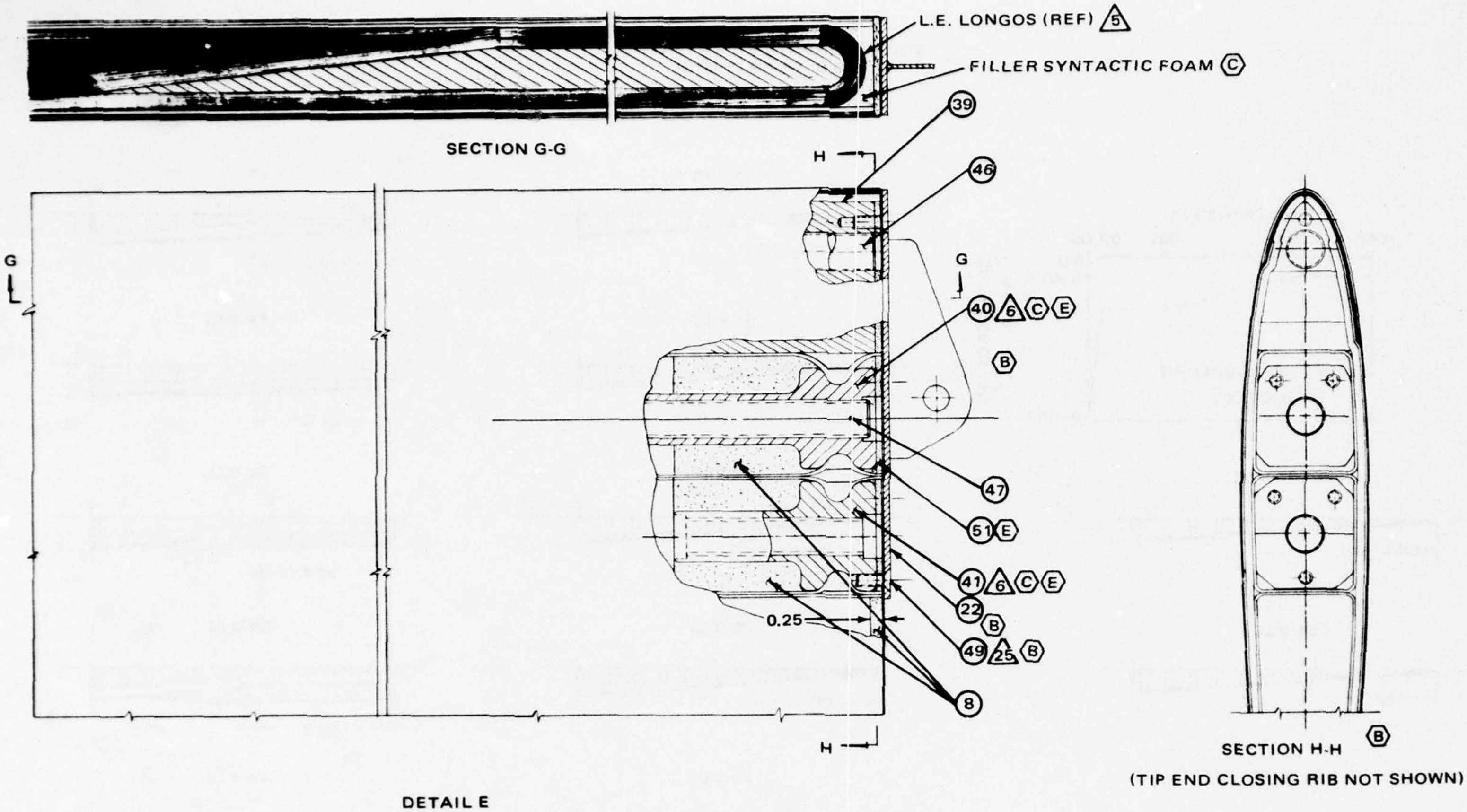


Figure 43. MTS blade tip section.

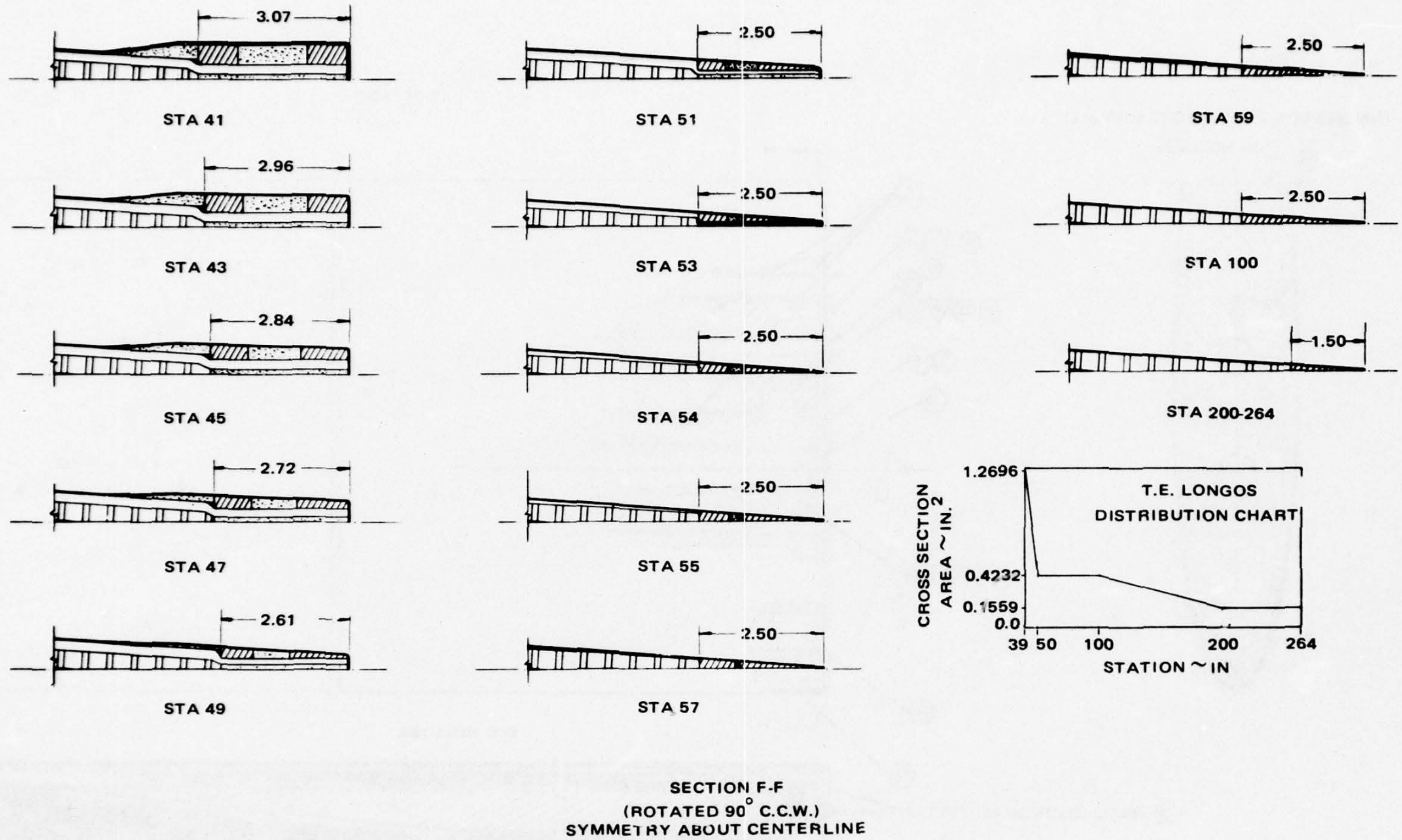
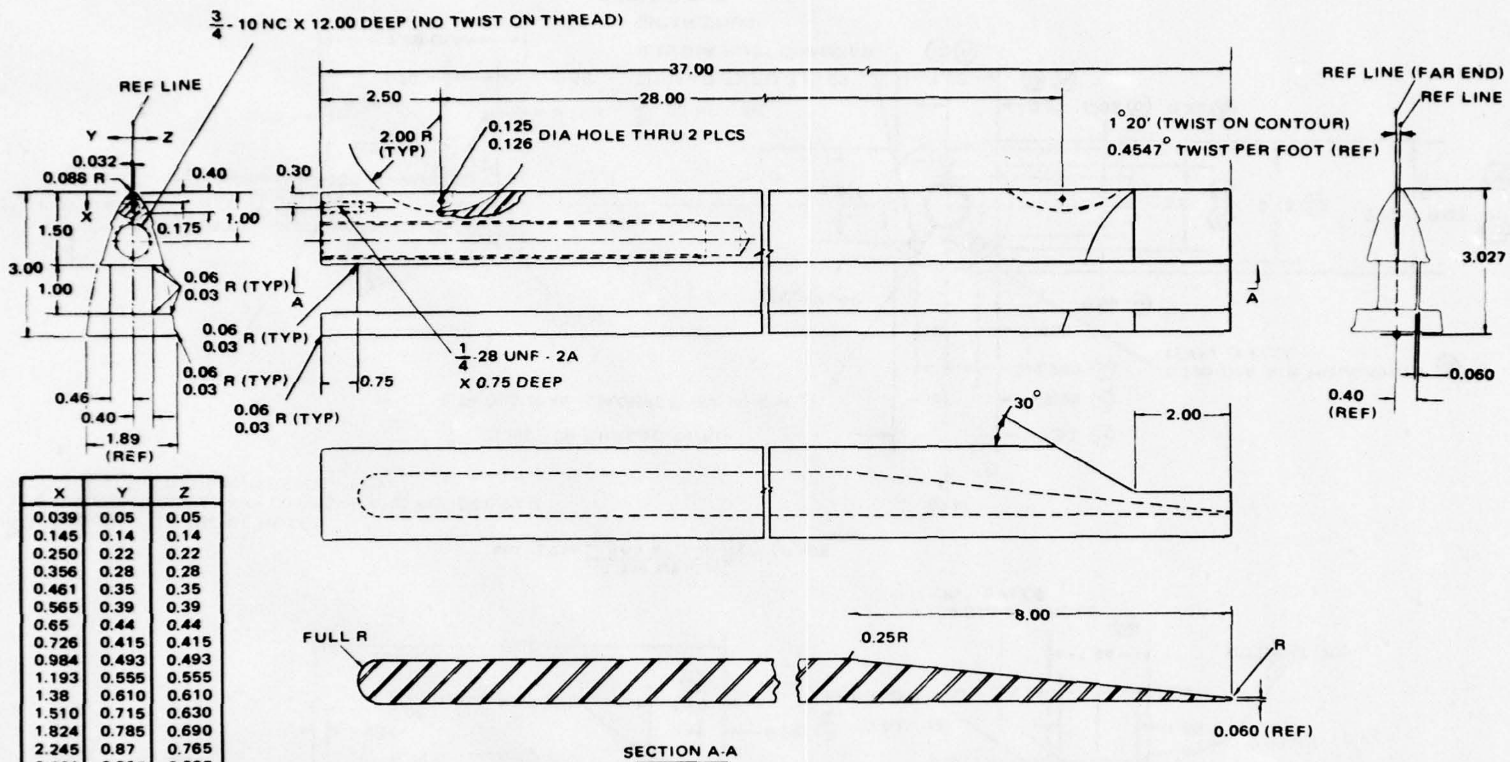


Figure 44. MTS blade trailing edge longo cross section.



X	Y	Z
0.039	0.05	0.05
0.145	0.14	0.14
0.250	0.22	0.22
0.356	0.28	0.28
0.461	0.35	0.35
0.565	0.39	0.39
0.65	0.44	0.44
0.726	0.415	0.415
0.984	0.493	0.493
1.193	0.555	0.555
1.38	0.610	0.610
1.510	0.715	0.630
1.824	0.785	0.690
2.245	0.87	0.765
2.661	0.935	0.825
2.870	0.960	0.870
2.99	0.965	0.965

MATERIAL – SAE STANDARD NO. 40 RED BRASS OR EQUIV DENSITY TO BE 0.31 LB/IN.^{3}

Figure 45. MTS blade leading edge tip weight.

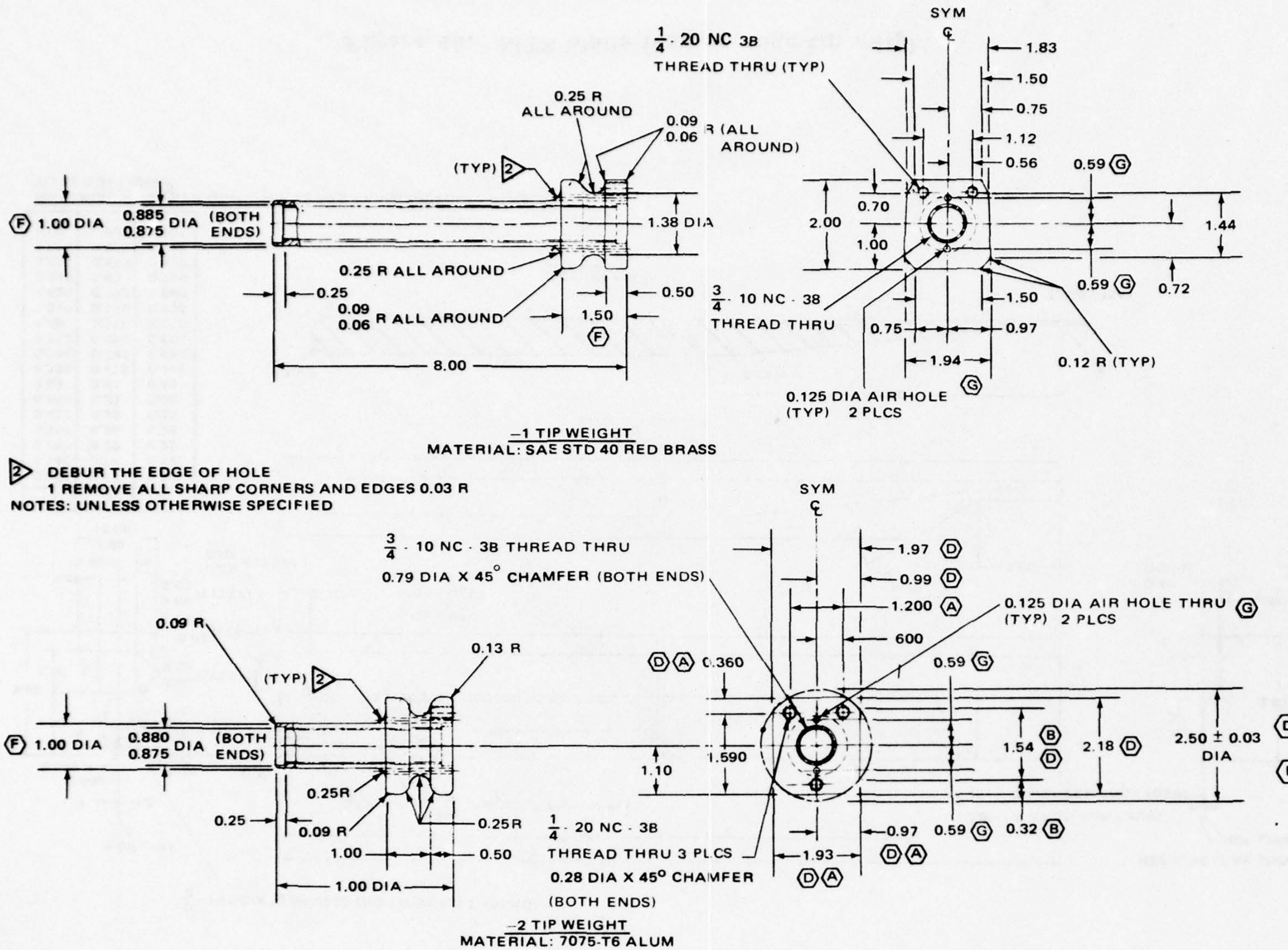


Figure 46. MTS blade spar tube tip weights.

and as a handling tool for moving the longo from the winding fixture to the blade mold. This tray, and all the other trays that will be described, is molded into the blade and becomes a permanent part of it.

The Kevlar-49 broom longo serves the same purpose that doublers serve in a metal blade: they increase stiffness and strength in the blade root area. These are unidirectional filaments that are step-tapered toward the root of the blade. One-fourth of the broom longos run from BS 85 inboard around the bushing and back out to BS 85. One-fourth of the longos are cut off at BS 74, one-fourth at BS 63, and the final fourth at BS 52. At the bushing the broom longo pack is 0.18 inch deep and 1.78 inches wide. The broom longo is wound into its own fiberglass tray.

The honeycomb panel that supports the aft skin is 3-pounds-per-cubic-foot, 1/8-inch cell Nomex, 3/8 inch thick. The leading and trailing edges are beveled. A single layer of Style 112 fiberglass fabric is bonded onto the side of the honeycomb away from the outside of the blade to stabilize the honeycomb and to protect the thin No. 5 spar tube from the sharp edges of the honeycomb.

The trailing edge (TE) longo is a unidirectional pack of Thornel-300 filaments that loop around the drag brace bushing at the inboard trailing edge of the blade. This longo, which provides chordwise bending stiffness, has a triangular cross section whose cross-sectional area decreases toward the tip of the blade as shown in Figure 44. A Thornel-300 TE broom longo adds reinforcement at the root. The cross-sectional area of this broom may be seen in Figure 44 inboard of BS 50. Both the full-length TE longo and TE broom longo have their own trays. A strip of 120-mesh aluminum screening woven from 4-mil wire is placed between the TE longo and the upper skin for lightning protection. It serves to conduct the lightning energy to the drag brace bushing from which it flows into the drag brace and hub.

The spar cap is a flattened tube wound at ±45 degrees from 11 layers of Kevlar-49, making it 0.132 inch thick. The spar tube is wound over a layer of film adhesive that remains inside the spar cap to assure a good bond when the tube is flattened. The spar cap extends from the nose of the airfoil where it butts against its partner in the other half of the blade, and runs aft to lap over the beveled leading edge of the honeycomb panel. The spar cap provides the major portion of the torsional stiffness. It has constant cross section from root to tip. A strip of RAM is wound into the spar cap at its leading edge.

The leading edge (LE) longo is a unidirectional pack of S-glass filaments that loop around the main retention bushing. This longo provides chordwise stiffness and has enough strength to carry all the centrifugal load by itself.

This longo, which is wound into a tray, has a constant cross section of 3.638 square inches inboard of BS 228. This longo is the only nonsymmetrical element in the blade: the lower LE longo stops at BS 228; 66 percent of the upper longo stops there, too. The remainder of the upper LE longo extends to the tip (BS 264) to form a loop around the grooved LE tip weight, tying the weight directly to the root bushing. A narrow strip of RAM is placed between the LE longo and the spar cap where they meet at the front of the blade.

The LE tip weight is a brass block that fills the forward portion of the blade (Figure 45). It has a spanwise groove through which the upper LE longos pass, and a threaded hole in the tip to accept the adjustable tungsten weights used to balance the blade.

The blade-root reinforcement is a layered pack of WFW S-glass broadgoods. It is 18 layers thick (0.180 inch) from the blade root to BS 51. Then it uniformly steps down three layers at a time until the tip of the final three layers is at BS 85. The filaments in all these layers are oriented at ±45 degrees to the blade span axis for torsional rigidity.

The doily, a hoop-wound ring of S-glass filaments 0.10 inch thick by 0.78 inch wide, is placed over the drag bushing to reinforce the fiberglass blade-root reinforcement for the chordwise loads that are induced in the blade by the drag link itself.

A film adhesive is used as a vacuum diaphragm to compact the skin, honeycomb, spar cap, and longos onto the mold. This film is bonded into the blade during the co-cure and becomes a permanent part of it.

The spar tubes are numbered one through five, counting aft from the nose of the blade. Numbers one through four are each wound from six layers of Kevlar-49 at ±45 degrees, with a final outer hoop winding.

The tube wall thickness is 0.048 inch. The No. 5 spar tube (the one under the honeycomb panels) consists of a single ±57-degree layer of S-glass (0.010 inch thick). All five tubes are wound on inflatable Tedlar mandrels that remain in the blade to serve as vapor barriers. The aft side of the No. 4 spar tube is reinforced with 2-inch-wide strips of filament-wound S-glass broadgoods, set on at ±45 degrees, which serve as the closing web for blade torsion loads. It is wound into the tube and consists of nine layers from the root to BS 85, six layers from BS 85 to BS 175, and three layers out to BS 220. The spar tubes contribute a small amount to the blade torsional stiffness, but more importantly serve as alternate load paths in case of ballistic damage. A primary function occurs during fabrication of the blade when these five tubes are inflated to pressurize the blade components during the co-cure cycle.

A brass tip weight is wound into the outboard end of the No. 1 spar tube, and an aluminum tip weight into No. 2. Figure 46 shows that these weights have a small diameter neck at the outboard end into which the filaments of the tube are wound for excellent mechanical entrapment. These weights are threaded to accept adjustable tungsten balance weights. Spar tubes No. 3, 4, and 5 do not have tip weights.

A number of cavities near the root end of the blade, such as the triangular regions between the longo filaments and the bushings and the space just aft of the spar broom longo and just forward of the TE broom longo, are filled with syntactic foam (glass microballoons and epoxy). The spar and the TE longo cavities are filled with milled E-glass fibers and epoxy for the added strength needed in the ground flapping mode. All these elements are co-cured to form the basic blade.

When it is removed from the mold, the blade has approximately 2 feet of extra material on each end. This surplus is cut off, and the flashing is trimmed from the leading and trailing edges.

Note that in Figure 42 an indentation reaches 1.5 inches back from the leading edge on the top surface and 3.0 inches on the bottom. In this indentation there is first placed a strip of RAM and then three layers of ±45-degree filament-wound S-glass broadgoods. This material is cured in place in a secondary bonding operation using APCO 2434/2340 room-temperature curing resin. This still leaves an indentation around the nose of the airfoil that is later filled flush with a strip of polyurethane antierosion material, Reference 1.

One-quarter-inch styrofoam dams are inserted in the No. 3, 4, and 5 spar tubes, one-fourth inch in from the trimmed ends of the blade (root and tip); this one-quarter-inch space is filled with syntactic foam. The cavities around ends of the leading edge and No. 1 and 2 tip weights are filled flush with the tip with syntactic foam. Styrofoam dams are placed in the root ends of spar tubes No. 1 and 2, approximately 7 inches in from the root end. These spaces between the dams and root end are filled with milled E-glass/epoxy. The hardener used in this epoxy and in the syntactic foam cures at room temperature. After this material sets, a three-layer tip cap and a seven-layer root cap are hand molded in place, again with a room-temperature setting resin.

The blade is then stood up on its tip end, and syntactic foam is injected into the tip ends of spar tubes No. 1 and 2 to the depth of the tip weights to make them rigid with respect to the spar tube walls (Figure 43).

ANALYSES

Weight and Balance Analysis

The weight and balance analysis for the MTS blade was calculated from the density and volume of the components. The weight of each WFW component was determined before it was wound, and the weight of each detail part was controlled to within ±3 percent during the winding operation (see the weight inspection and verification process in Volume II).

The details of the weight and balance analysis are given in Appendix A. The important parameters are summarized in Table 6. The weight and chordwise center of gravity distributions along the span of the blade are plotted in Figures 47 and 48, respectively. Comparisons are given with the 540 metal blade characteristics.

Stress Analysis

The stress analysis of the MTS blade follows conventional practice with allowable loads being derived from the strength properties of the filaments and their combination with the resin matrix that supports them. These allowables are modified where necessary in light of the test data accumulated in the materials test program.

A search was made through a 540 blade flight loads report, Reference 3, to determine the maximum loads encountered. Because the MTS blade is designed to have similar weight, stiffness, and dynamic properties, it was assumed that these maximum loads would also apply to the MTS blade. Consequently, the MTS blade is designed to withstand all of these loads without ever going over the allowables - the definition of an infinite life design.

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3. Adaska, W. W., QUALIFICATION LOAD LEVEL SURVEY FOR IMPROVED MAIN ROTOR BLADES ON THE MODEL AH-1G HELICOPTER, Report 209-099-305, Bell Helicopter Company, Fort Worth, Texas, 5 June 1970.

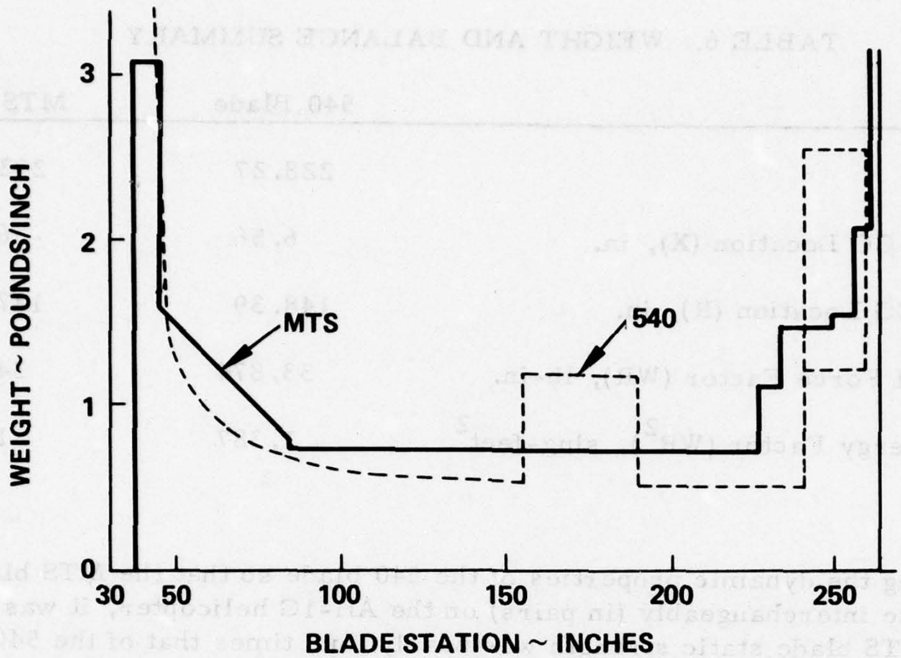


Figure 47. Spanwise weight distribution.

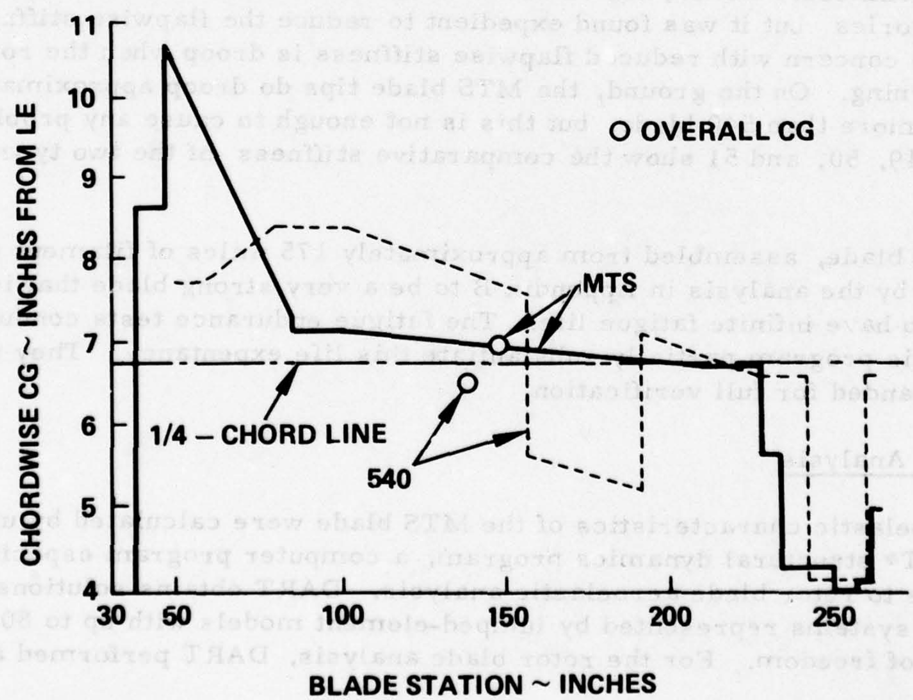


Figure 48. Spanwise center of gravity distribution.

TABLE 6. WEIGHT AND BALANCE SUMMARY

	540 Blade	MTS Blade
Weight, lb	228.27	232.95
Chordwise CG Location (X), in.	6.56	6.94
Spanwise CG Location (R), in.	148.39	147.43
Centrifugal Force Factor (WR), lb-in.	33,874	34,344
Kinetic Energy Factor (WR^2), slug-feet^2	1,387	1,395

In matching the dynamic properties of the 540 blade so that the MTS blade can operate interchangeably (in pairs) on the AH-1G helicopter, it was found that the MTS blade static strength was nearly four times that of the 540 blade. The match of torsion stiffness and chordwise bending stiffness is more important from a rotor dynamics point of view than the match of flapwise bending stiffness. Hence, the MTS blade matches the 540 blade in the first two categories, but it was found expedient to reduce the flapwise stiffness. The main concern with reduced flapwise stiffness is droop when the rotor is not turning. On the ground, the MTS blade tips do droop approximately 3 inches more than 540 blade, but this is not enough to cause any problem. Figures 49, 50, and 51 show the comparative stiffness of the two types of blade.

The MTS blade, assembled from approximately 175 miles of filament rovings, is shown by the analysis in Appendix B to be a very strong blade that is calculated to have infinite fatigue life. The fatigue endurance tests conducted during this program partially substantiate this life expentancy. They need to be expanded for full verification.

Dynamic Analysis

The aeroelastic characteristics of the MTS blade were calculated by use of the DART* structural dynamics program, a computer program especially adaptable to rotor blade aeroelastic analysis. DART obtains solutions for dynamic systems represented by lumped-element models with up to 80 degrees of freedom. For the rotor blade analysis, DART performed a fully

*DART - Dynamic Analysis Research Tool

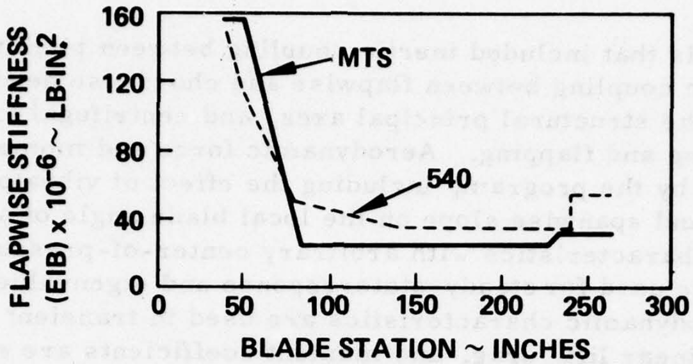


Figure 49. Flapwise bending stiffness comparison, MTS and 540 blades.

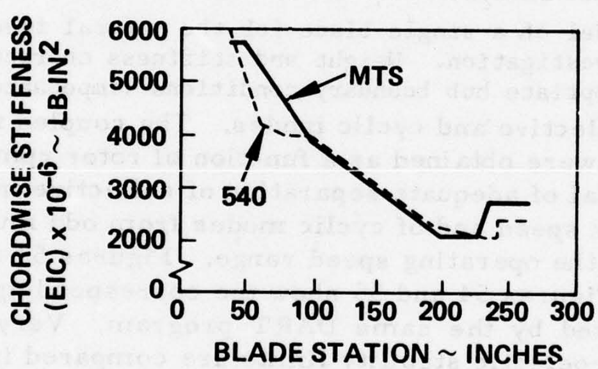


Figure 50. Chordwise bending stiffness comparison, MTS and 540 blades.

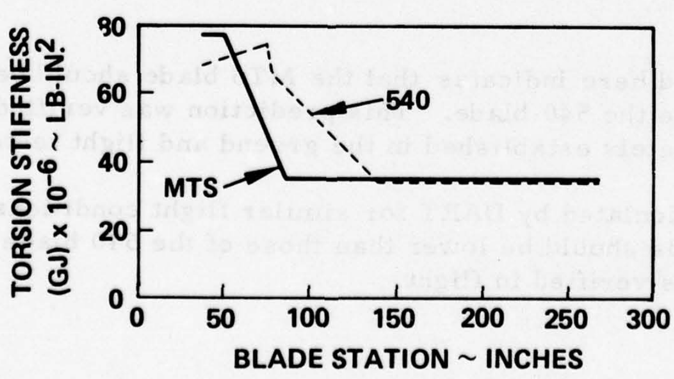


Figure 51. Torsion stiffness comparison, MTS and 540 blades.

coupled analysis that included inertia coupling between pitching and flapping motion, elastic coupling between flapwise and chordwise bending due to inclination of the structural principal axes, and centrifugal force coupling between pitching and flapping. Aerodynamic force and moment distributions are calculated by the program, including the effect of vibratory structural deformations and spanwise slope on the local blade angle of attack. Linear aerodynamic characteristics with arbitrary center-of-pressure and lift-curve slope are used for steady-stateresponse and eigenvalue solutions. Nonlinear aerodynamic characteristics are used in transient solutions in which the nonlinear lift, drag, and moment coefficients are entered as arbitrary functions of Mach number and angle of attack; the effects on lift and moment (including phase lag and hysteresis) due to dynamic stall and the effects of yawed flow on the maximum lift coefficient are accounted for.

The DART program analyzed the dynamics of the blade using an 11-station lumped-element model of a single blade for the natural frequency and linearized stability investigation. Weight and stiffness characteristics are listed in Table 7. Appropriate hub boundary conditions (impedances) were used to obtain both collective and cyclic modes. The coupled natural frequencies and mode shapes were obtained as a function of rotor rpm and collective pitch, with the goal of adequate separation of collective modes from even multiples of rotor speed and of cyclic modes from odd multiples of rotor speed throughout the operating speed range. Figures 52 and 53 are the MTS blade fan plots; Figures 54 and 55 show the corresponding 540 blade frequencies calculated by the same DART program. Very little difference can be seen. Aeroelastic stability limits are compared in Figure 56. The MTS blade first collective chordwise bending is shown to be very close to the stability boundary for the condition of no internal structural damping at or above the design rpm. A calculation assuming 5 percent structural damping showed that even this low level of internal damping makes the blade stable.

The data plotted here indicates that the MTS blade should behave in flight very nearly like the 540 blade. This prediction was verified by dynamics tests and ultimately established in the ground and flight tests.

Blade loads calculated by DART for similar flight conditions show that the MTS blade loads should be lower than those of the 540 blade (Figure 57). This thesis was verified in flight.

TABLE 7. MTS BLADE MASS AND STIFFNESS CHARACTERISTICS

BS (in.)	Flapwise EIF (10^6 lb-in^2)	Chordwise EIC (10^6 lb-in^2)	Torsion GJ (10^6 lb-in^2)	Neutral Axis NA (in.*)	CG (in.*)	Weight W (lb/in.)
41	156.0	5740	77.0	8.72	8.63	3.086
46	156.0	5740	77.0	8.72	8.63 and 10.67	3.086 and 1.594
52	156.0	5740	77.0	8.72	10.15	1.470
63	112.2	5123	63.0	8.65	9.18	1.243
74	68.5	4507	49.0	8.58	8.25	1.015
85	24.8	3890	35.0	8.51	7.29 and 7.13	0.788 and 0.730
96		3890		8.51	7.13	0.730
100		3890		8.51	7.11	0.730
107		3763		8.39	7.08	0.729
118		3562		8.19	7.04	0.727
129		3362		8.00	6.99	0.725
140		3162		7.81	6.95	0.723
151		2962		7.61	6.90	0.722
162		2762		7.42	6.87	0.720
173		2561		7.23	6.83	0.718
184		2361		7.03	6.80	0.716
195		2161		6.84	6.77	0.714
200		2070		6.75	6.75	0.713
206		2070		6.75	6.70	0.712
217		2070		6.75	6.70	0.710
228		2070		6.75	6.70 and 5.64	0.709 and 1.104
234		2760		4.21	5.64 and 4.30	1.104 and 1.465
239		2760		4.21	4.30	1.465
250		2760		4.21	4.30 and 4.05	1.465 and 1.537
257		2760		4.21	4.05 and 4.12	1.537 and 2.060
262	24.8	2760	35.0	4.21	4.12 and 5.00	2.060 and 3.125

*Measured from leading edge

Mass Moment of Inertia (Including Hub)

Flapwise / Chordwise } about rotor center = 6,586 x 10^6 lb-in^2

Pitchwise, about quarter chord = 12,096 lb-in^2

Twist

Root-to-Tip = -10° (-0.003788 degrees/inch)

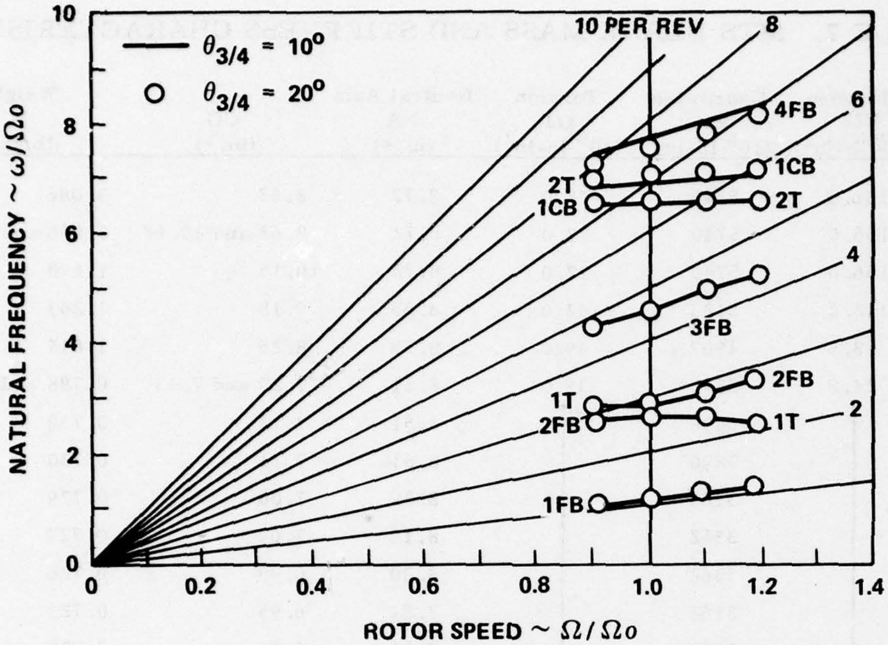


Figure 52. MTS blade – collective roots.

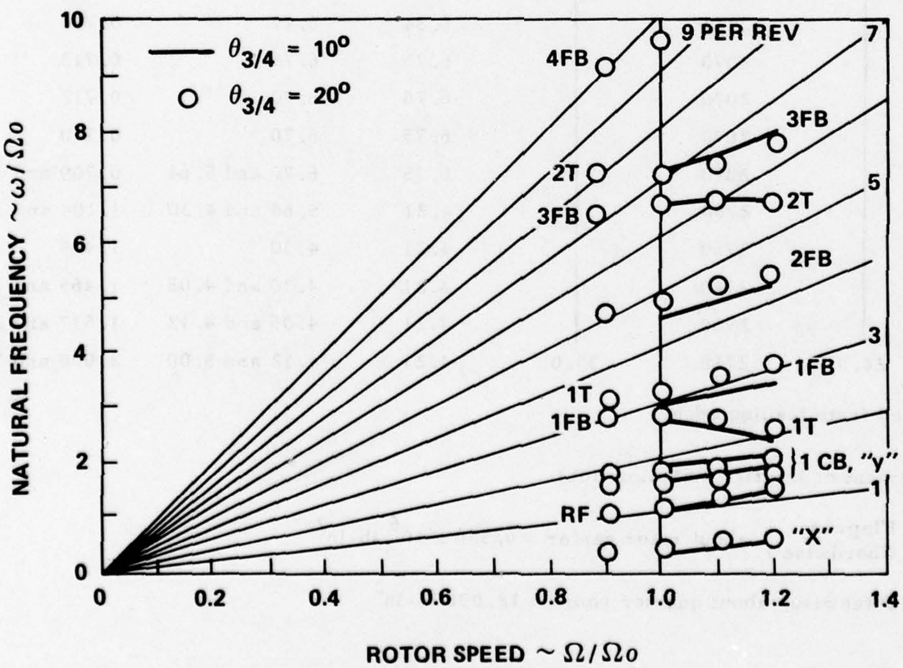


Figure 53. MTS blade – cyclic roots.

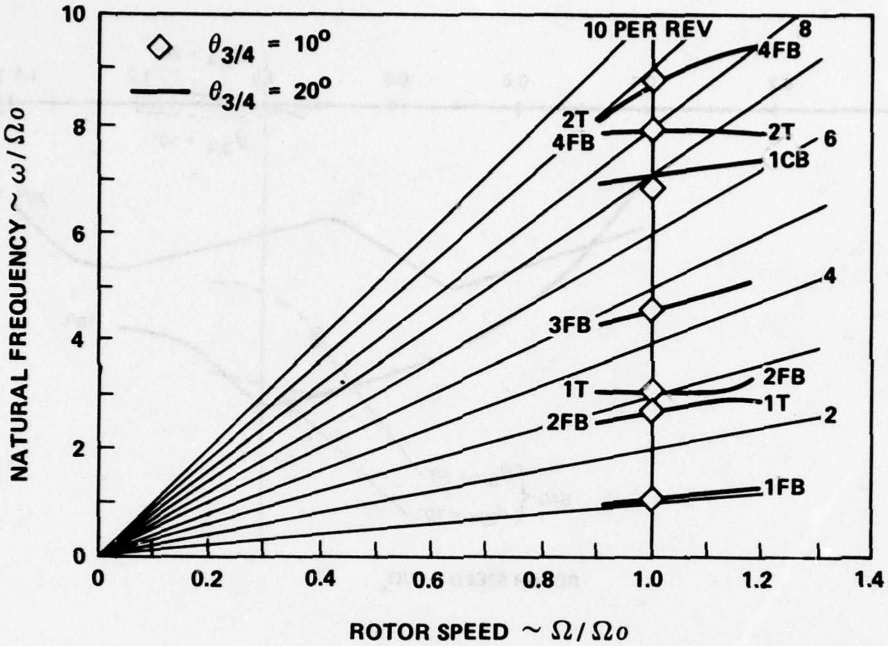


Figure 54. 540 blade — collective roots.

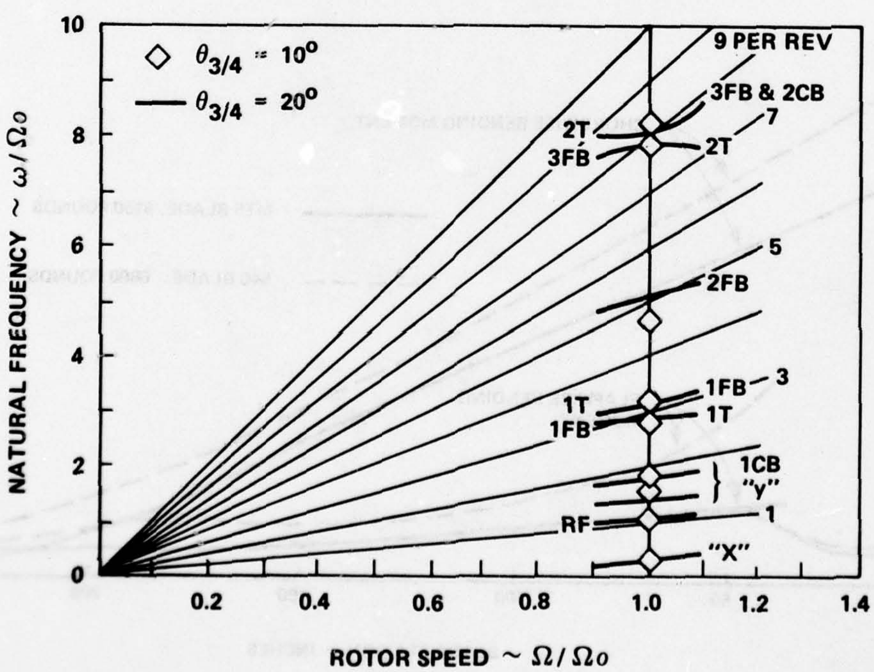


Figure 55. 540 blade — cyclic roots.

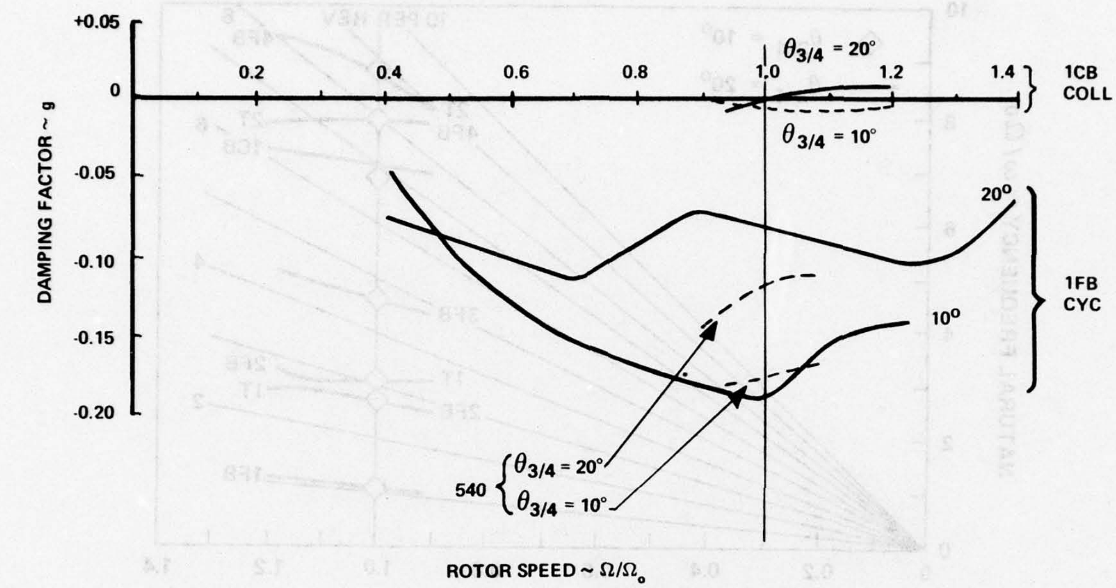


Figure 56. MTS blade damping comparison (zero structural damping).

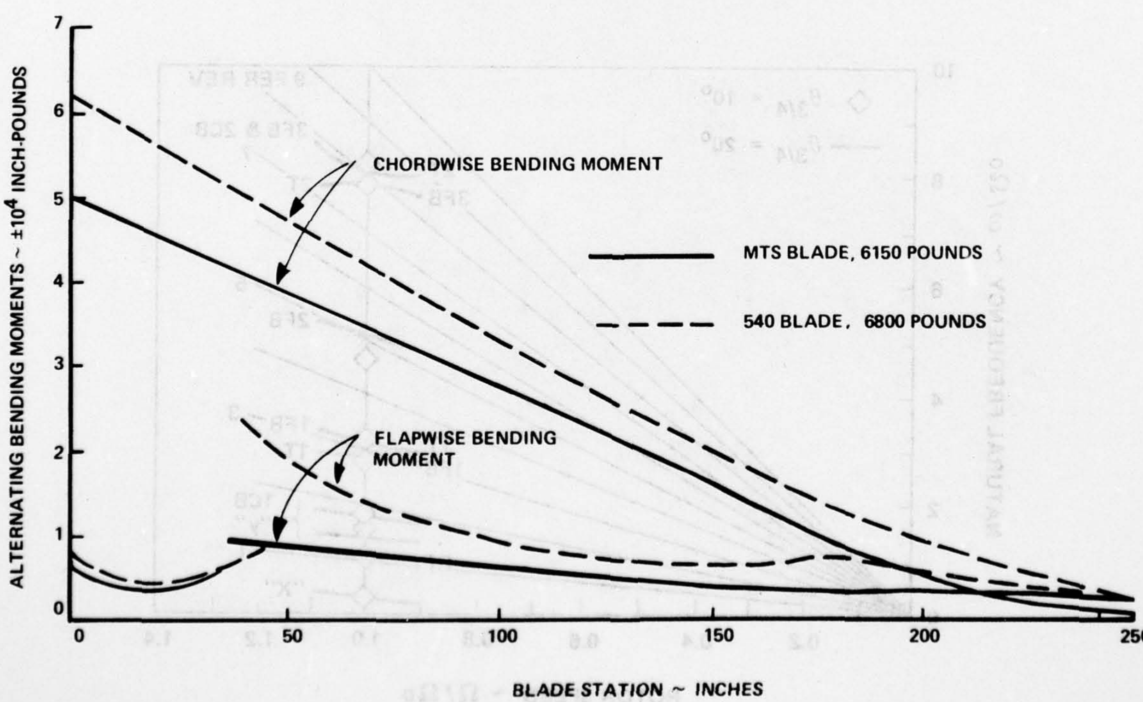


Figure 57. Calculated blade loads in level flight at 140 knots.

SECTION III – LABORATORY TESTS

The laboratory tests carried out on the full-scale MTS blade are described in this section. This test work demonstrated that the blade strength, stiffness, and dynamic properties were suitable for flight. The blades were built as complete, full-length blades. All blades except the flight test blades were cut into segments with the various segments being assigned to specific tests as indicated in Figure 58.

All eight MTS test blades were used in these structural tests. The stiffness of each blade was measured. S/N-001 and -002 were used for static test, fatigue test, radar test, ballistic test, and dynamic test (S/N-001 had metal weights clamped to its tip to give it the proper mass distribution). S/N-003 and -004 were used primarily for fatigue tests (although a portion of S/N-003 was used for a radar test in an allied program, Reference 2). The S/N-005 blade was subjected to 23mm HEI-T ballistic damage and then fatigue tested to demonstrate its fly-home ability. (An outboard segment of S/N-005 was also used in the referenced radar test.) The two flight test blades, S/N-006 and -007, were subjected to dynamic tests to establish their natural frequencies and mode shapes.

All structural load tests were conducted in HH's Structures Test Laboratory to establish that the static and fatigue strength, stiffness, and dynamic characteristics of the MTS blade were in agreement with the predicted values, and that the concept was ready for its ground and flight tests. For comparison, certain of the tests were duplicated for a pair of production metal (540) blades (NSN 1615-00-178-9680).

STIFFNESS TESTS

The first test for each MTS blade as it came off the production line was the measurement of its stiffness: flapwise, torsional, and chordwise. Each blade was supported in a cantilever mount by its two root attachment points, and its tip was stabilized at the quarter-chord point to eliminate unwanted cross deflections. Figure 59 shows the MTS blade undergoing these tests.

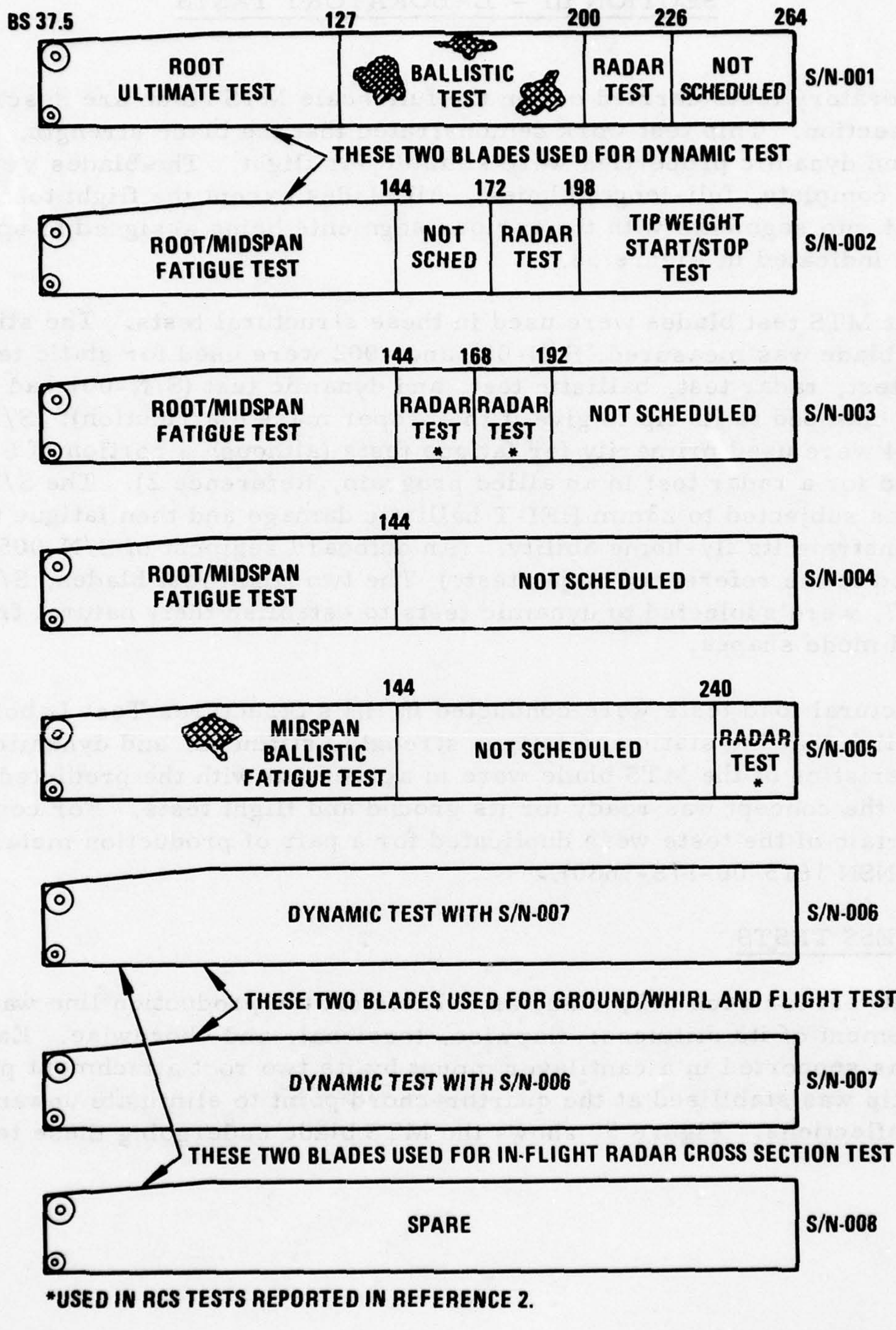
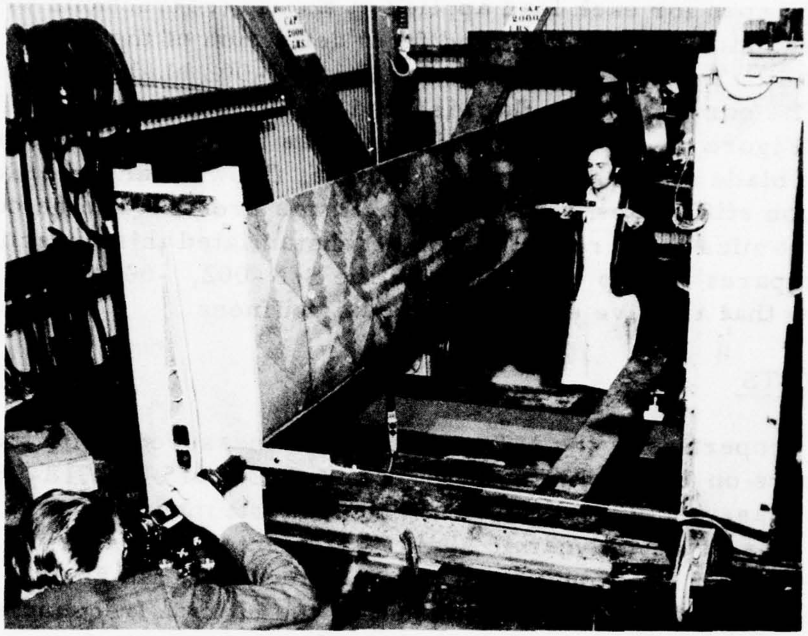
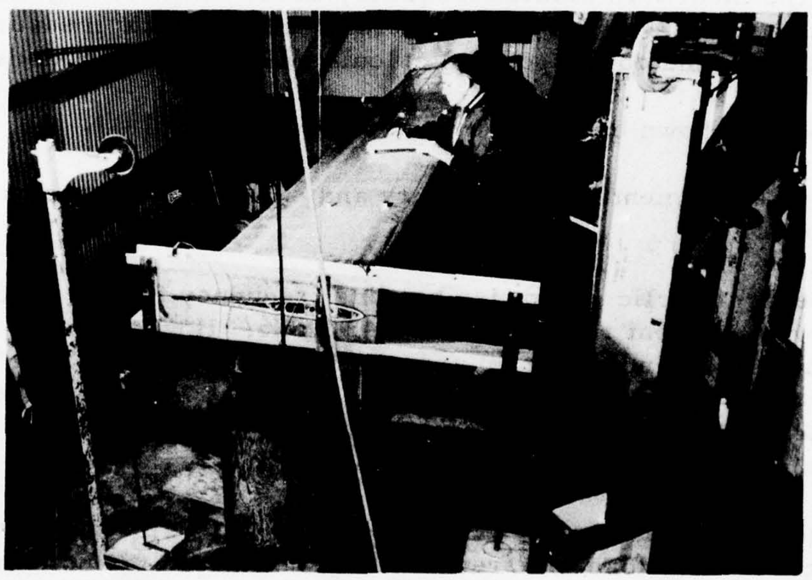


Figure 58. MTS blade structure test assignments.



Flapwise Measurement



Torsion Measurement

Figure 59. Blade stiffness tests.

The flapwise and torsion deflections were measured at a series of points along the blade span for each load applied at the tip (corrections were made for the root-end motions that resulted from deflection of the cantilever support under load). Typical deflections for the S/N-002 blade are shown in Figure 60. The corresponding flapwise and torsion stiffness distributions are shown in Figure 61. The axial stiffness was too high to measure reliably along the blade span, but since the weight, flapwise and chordwise bending, and torsion stiffnesses were correct, it was presumed to be correct also. The dynamics tests reported below substantiated this presumption. Figure 62 compares the tip deflections of the S/N-002, -006, -007, and -008 blades to show that all have essentially equal stiffness.

DYNAMIC TESTS

The dynamic properties of the MTS blades were measured while they were mounted in pairs on an AH-1G main rotor hub (NSN 1615-00-918-9357). The blade-plus-hub assembly was suspended from a soft mount (Figure 63) and was vibrated by an electrodynamic shaker at selected points on the hub to induce collective and cyclic natural frequency modes in the blades. Suitably placed accelerometers (Figure 64) measured the natural frequencies and mode shapes as the shaker was driven through an automatic frequency sweep from 3 to 60 hertz. The complete set of blade frequency/acceleration sweep curves for the S/N-006, -007 blade combination is given in Appendix C. From these, the measured natural frequency/mode shape data given in Table 8 was deduced. This table also includes similar data measured for a pair of 540 blades, and corresponding calculated data for both kinds of blades.

The salient points shown by this comparison are:

a. Good agreement between theory and experiment is shown for all modes.

b. The first cyclic chordwise bending frequency for the MTS blade is down 6 percent relative to the 540 blade. However, the estimated frequency at normal rpm appears to be acceptable (1.54/rev at 10 degrees collective pitch and 1.35/rev at 20 degrees collective pitch). This is the most important single parameter for maintaining acceptable loads in a teetering rotor.

c. The first cyclic coupled flapwise bending/torsion modes are predicted to be close to 3/rev at 100 percent rpm for both the MTS and 540 rotors.

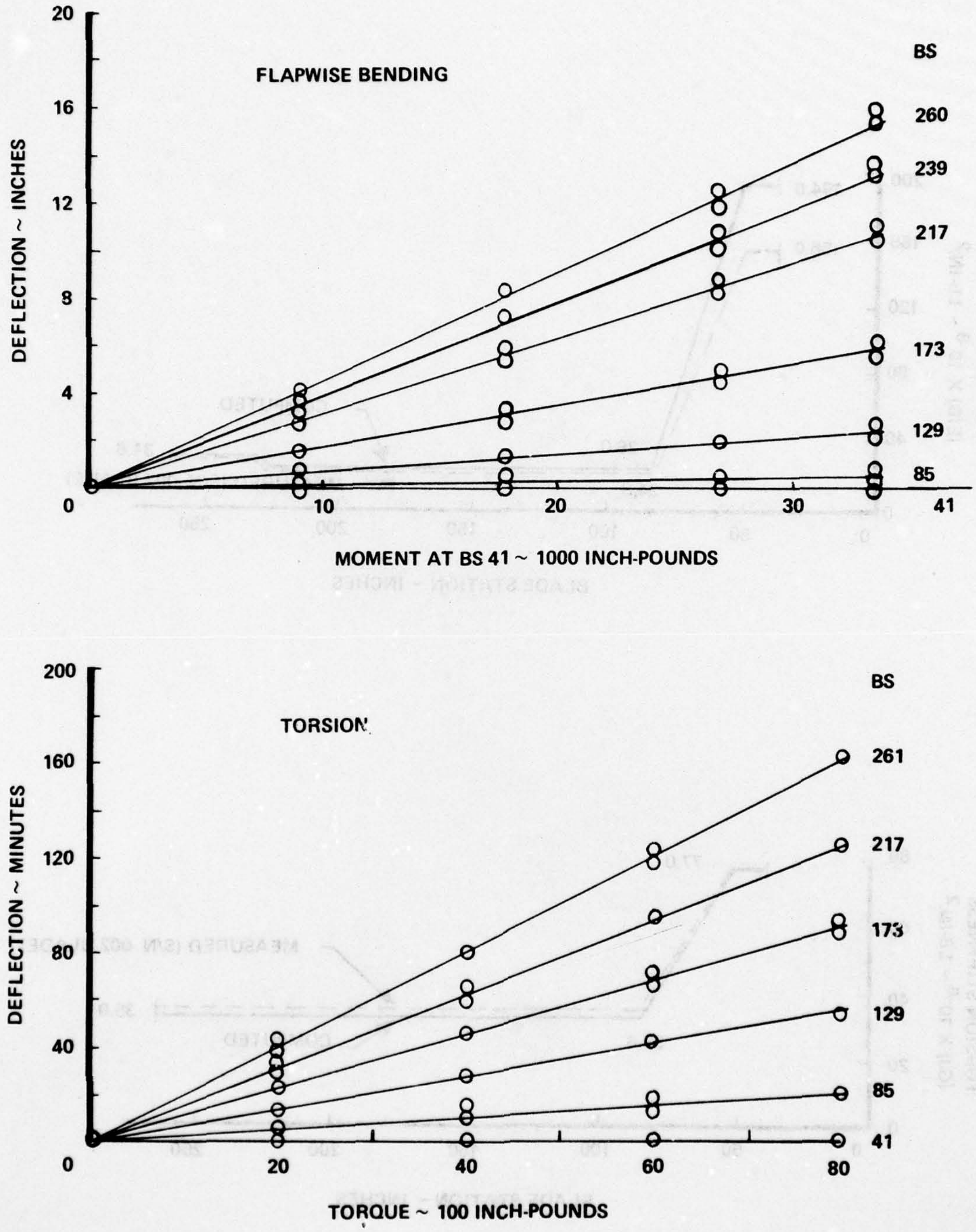


Figure 60. Flapwise and torsion stiffness – S/N-002 blade.

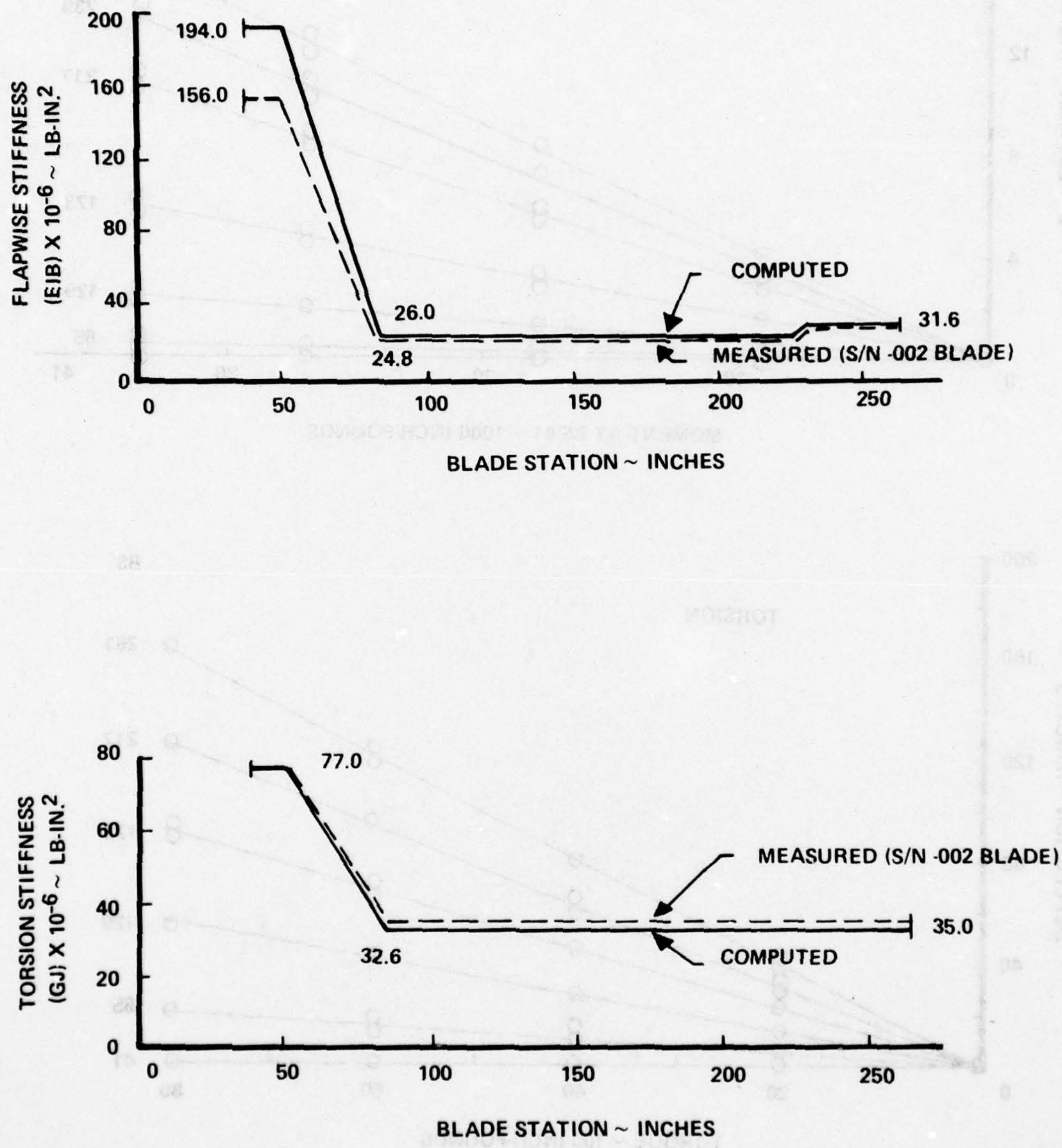


Figure 61. MTS blade spanwise stiffness distribution.

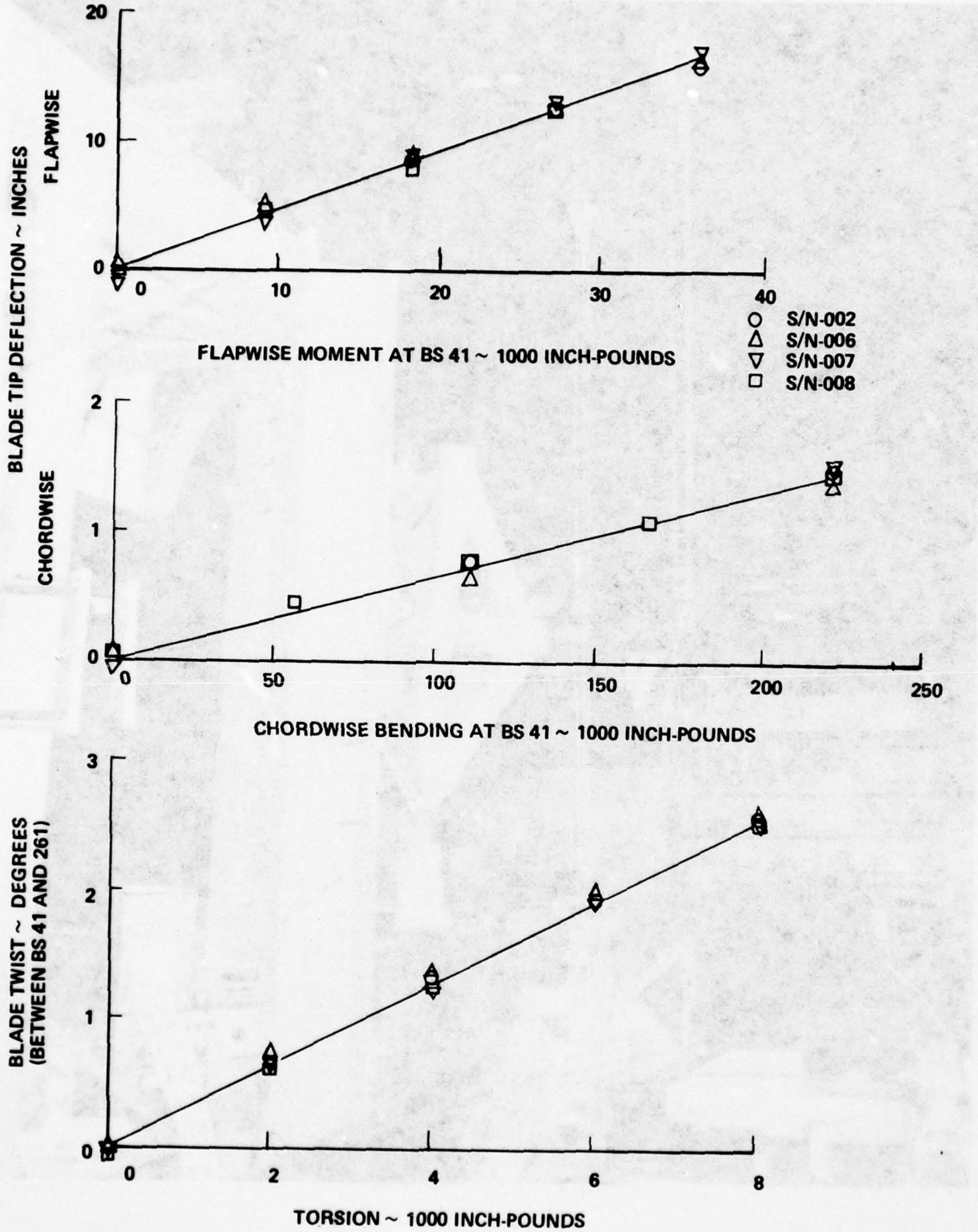


Figure 62. MTS blade stiffness comparison.

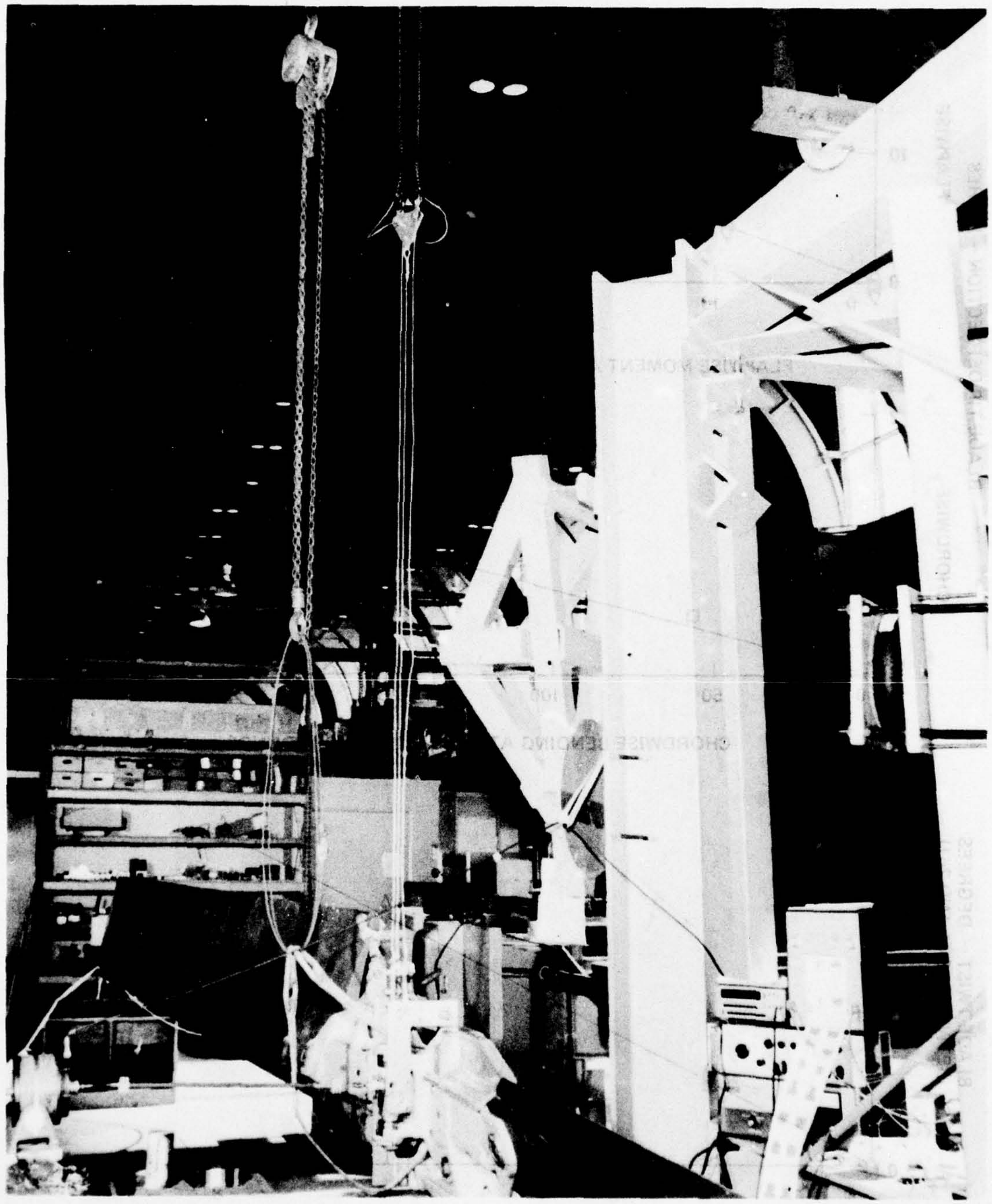


Figure 63. Rotor dynamic response test.

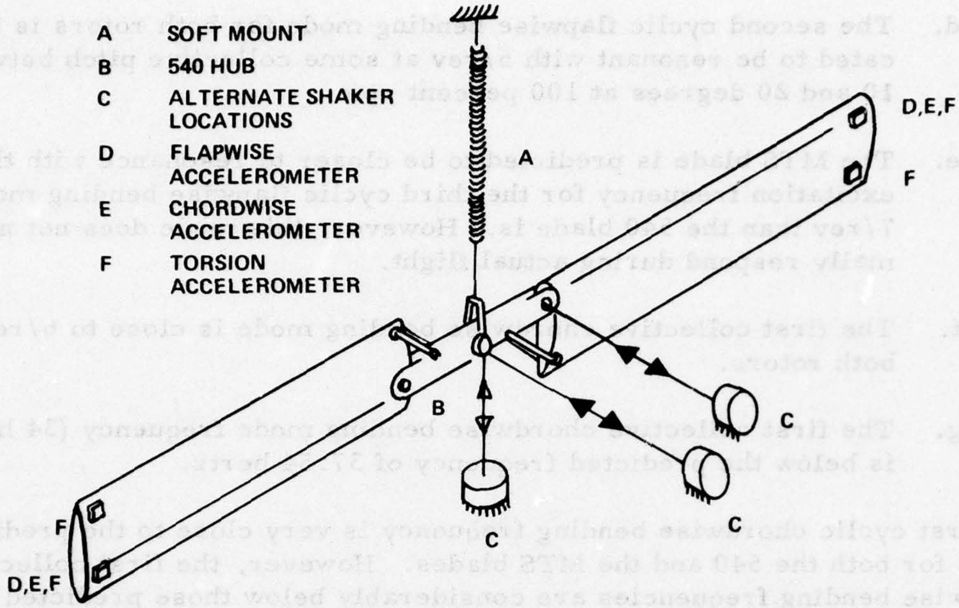


Figure 64. Dynamic test schematic.

TABLE 8. FREQUENCY COMPARISON – 540 ROTOR VERSUS MTS ROTOR

Mode*		540 Blades		S/N-006 and -007 MTS Blades	
Type	Boundary Condition	Experimental	Predicted	Experimental	Predicted
1FB	COLL	1.2	1.3	--	1.18
2FB	COLL	6.95	6.5	6.4	5.88
3FB	COLL	17.7	16.64	15.3	15.27
1T	COLL	22.3	21.8	--	22.45
1CB	COLL	33.0	39.90	34.0	37.56
4FB	COLL	38.2	33.47	29.3	30.56
1FB	CYC	4.05	3.76	3.6	3.23
1CB	CYC	9.3	9.37	8.6	8.87
2FB	CYC	15.3	14.7	14.1	15.32
3FB	CYC	29.9	32.15	26.2	26.32
1T	CYC	31.0	33.2	30.0	31.78

*FB: flapwise bending, CB: chordwise bending, T: torsion, COLL: collective mode, CYC: cyclic mode

d. The second cyclic flapwise bending mode for both rotors is indicated to be resonant with 5/rev at some collective pitch between 10 and 20 degrees at 100 percent rpm.

e. The MTS blade is predicted to be closer to resonance with the excitation frequency for the third cyclic flapwise bending mode at 7/rev than the 540 blade is. However, this mode does not normally respond during actual flight.

f. The first collective chordwise bending mode is close to 6/rev for both rotors.

g. The first collective chordwise bending mode frequency (34 hertz) is below the predicted frequency of 37.54 hertz.

The first cyclic chordwise bending frequency is very close to the predicted values for both the 540 and the MTS blades. However, the first collective chordwise bending frequencies are considerably below those predicted for both the 540 and the MTS blades. This indicates first collective chordwise bending operating frequencies at 100 percent rotor speed (324 rpm) close to 6/rev for the 540 blades (6.0/rev) and the MTS blades (6.2/rev). It is not considered desirable to have collective frequencies for a two-bladed rotor near an even integer multiple of the rotor speed, but apparently it is acceptable with the 540 blades. The MTS blades, being further from 6/rev, should be less critical.

Another effect of the first collective chordwise bending frequency observed for the inflight analysis of the MTS blade is the reduced damping at and above coalescence with the second torsion collective frequency. Reduction of the first collective chordwise bending frequency as in the MTS blade is beneficial in avoiding this coalescence.

ROOT ULTIMATE STRENGTH TEST

A test doubler was bonded onto the root-end segment of the S/N-001 blade, and this segment was tested in a 400,000-pound Baldwin Universal Test Machine (Figure 65) to measure its ultimate spanwise strength. The load at failure was 222,500 pounds, but the failure consisted of the test doubler delaminating from the blade, rather than a failure in the blade itself. An inspection of the blade structure showed no damage at this load level. The test load of 222,500 pounds is 23 percent above the design ultimate strength of 181,500 pounds at the root section blade station (BS 41), and 39 percent greater than the 150,000-pound ultimate load at the outboard end of the root doublers (BS 85).

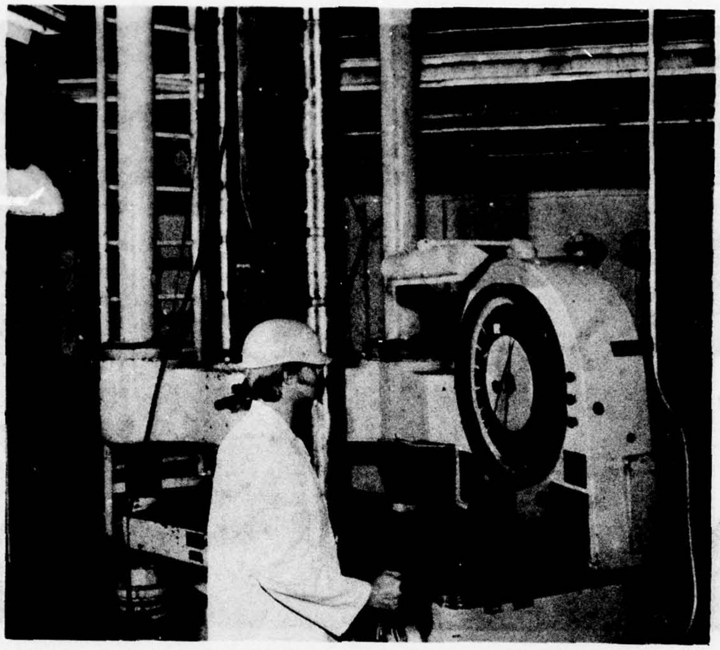


Figure 65. Root-end ultimate strength test (S/N-001 blade).

This test demonstrated that the MTS blade has more than adequate static strength. It also demonstrated the need for a better process for bonding the test doubler. Examination of the delamination, and subsequent tests, showed that bonding to cured Kevlar-49 is not satisfactory unless a fiberglass scrim cloth is placed over the Kevlar-49 before the Kevlar-49 doublers are bonded on. This process was used satisfactorily for the tip ground-air-ground cycle specimen and for the three root-end/midspan fatigue specimens, testing of which is described below.

GROUND-AIR-GROUND CYCLE TEST

The tip-end segment of the S/N-002 blade had a test doubler bonded to its inboard end. It was set up in the dynamic loading fixture shown in Figure 66 for the 1200-cycle ground-air-ground (GAG) test. (A 1200-cycle test was chosen to represent a factor of safety of 4 over the 300 actual start/stops that could be anticipated in the ground and flight test programs.)

ROOT/MIDSPAN FATIGUE TEST

A special fatigue test machine was developed for these tests. It is shown in its original configuration at the top of Figure 67, and as modified later at

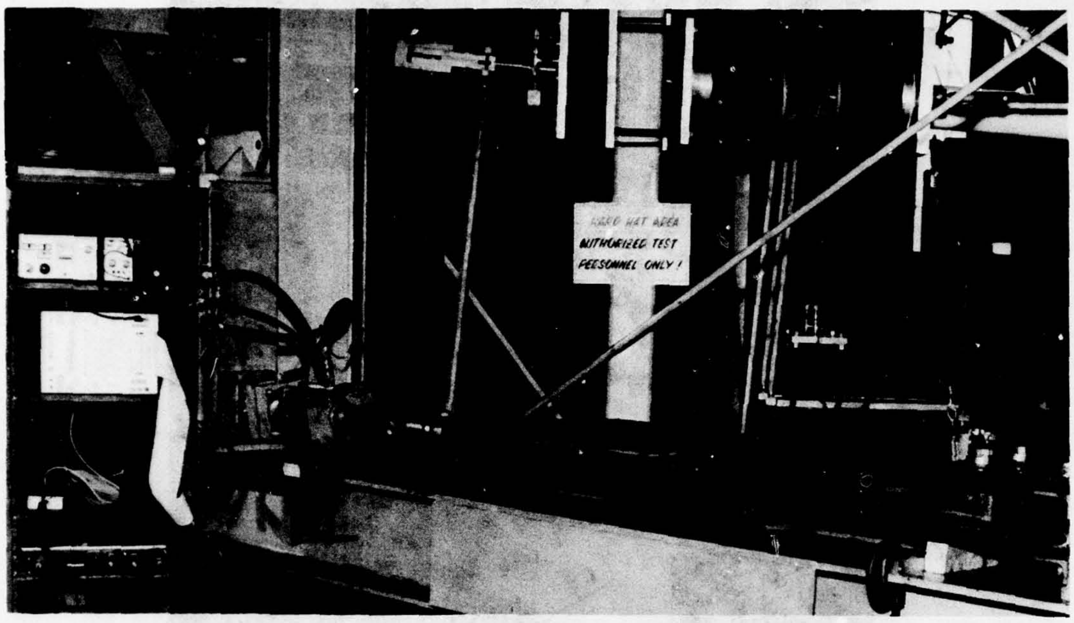


Figure 66. Ground-air-ground cycle test (S/N-002 blade).

the bottom of this figure. It was designed to permit testing the root end and the midspan region simultaneously, a new way of fatigue testing that avoids testing each section individually in two separate setups as in the usual case. The half-span blade was mounted as a cantilever beam at its root end and had doublers bonded on at its tip for introducing the simulated centrifugal force and the oscillating flap/chord/torsion fatigue force.

Strain gages on the blade, Table 9, measured blade loads. A hydraulic actuator applied the alternating load at a frequency near the flapwise bending natural frequency. This allowed chordwise bending moments to be introduced in proportion to the actuator force, and flapwise bending moments as a function of frequency. An offset weight aft of the trailing edge induced torsion from the flapwise input.

A desired alternating load level was established for the fatigue tests on the basis of 540 blade measured loads. These loads were imposed at a "weighted fatigue" level which equalled 1.3 times the maximum level flight loads, Reference 3, measured for the 540 blade. Two million cycles at this load level was established as the duration needed to give a 1.67 factor of safety for the 1,200,000 cycles to be expected at 2/rev during the 10-hour ground test and 20-hour flight test.

AD-A046 176 HUGHES HELICOPTERS CULVER CITY CALIF F/G 1/3
FLIGHT TEST OF A COMPOSITE MULTI-TUBULAR SPAR MAIN ROTOR BLADE --ETC(U)
AUG 77 R E HEAD DAAJ02-74-C-0055
UNCLASSIFIED HH-76-281-VOL-1 USAAMRDL-TR-77-19A NL

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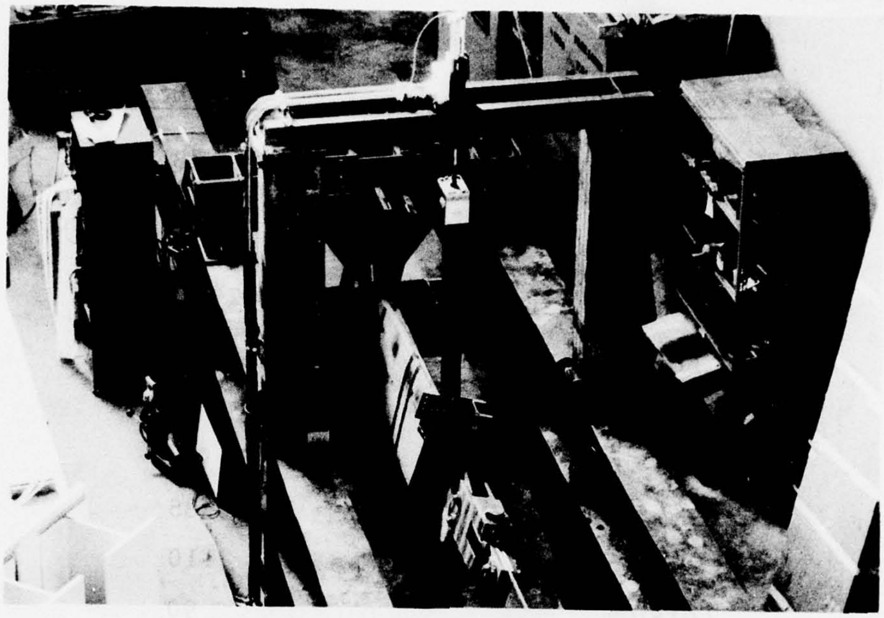
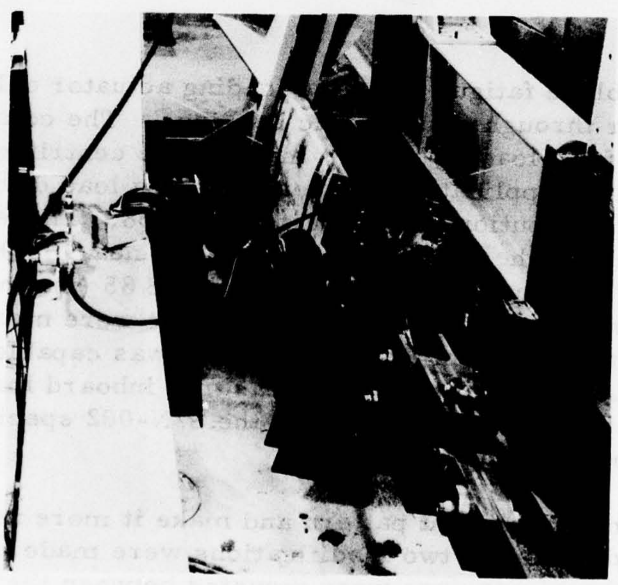


Initial Configuration - S/N-002 Blade Test



Final Configuration - S/N-003, -004, and -005 Blade Test

Figure 67. MTS blade fatigue test fixture.

TABLE 9. FATIGUE TEST BLADE STRAIN GAGE LOCATIONS

Mode	Blade Station (inches)
Flapwise Bending	48
	60
	85
	110
Chordwise Bending	Drag brace
	48
	60
	85
	110
Torsion	90

For the S/N-002 blade fatigue test, the loading actuator delivered its force to the blade collar through elastomeric bearings. The combination of blade stiffness, mass of the loading collar, mass of the centrifugal force mechanism, and the point of application of the alternating load developed a blade bending moment distribution as shown in Figure 68. There was a bending moment (flapwise and chordwise) inflection point near BS 97 which made it impossible to develop the desired moments at BS 85 (the inboard end of the blade midspan structure). The fatigue loads that were measured in this blade demonstrated that, inboard of BS 75, the blade was capable of carrying the required loads. A comparison of the measured inboard loads and blade spanwise structural properties indicated that the S/N-002 specimen had adequate strength throughout its length.

To modify the bending moment pattern and make it more nearly like the distribution expected in flight, two modifications were made to the fatigue test fixture. First, two air springs were mounted between the blade collar and the frame of the fixture. See the lower photograph, Figure 67. This changed the bending moment from that experienced by the S/N-002 blade (Figure 68) to the solid curves shown for S/N-003 in Figure 69. The S/N-003 blade was

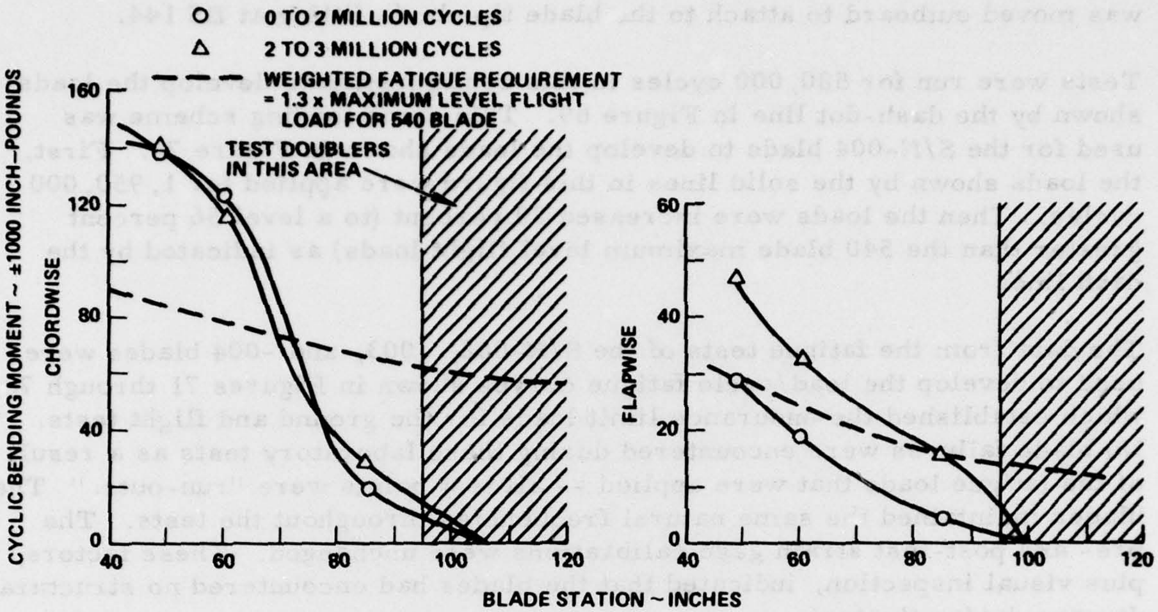


Figure 68. Fatigue test loading conditions – S/N-002 blade.

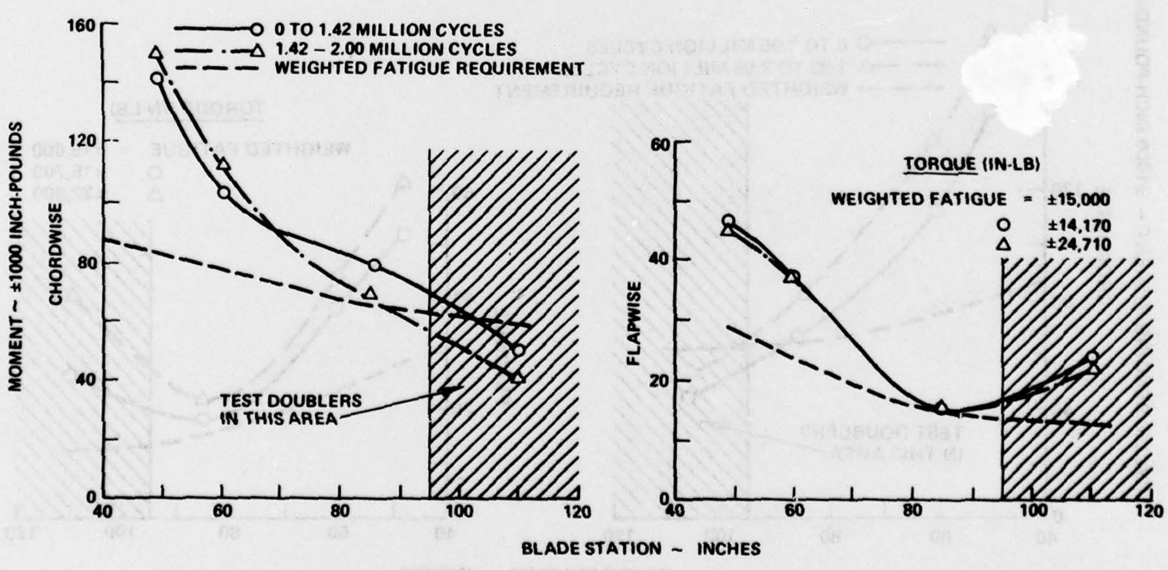


Figure 69. Fatigue test loading conditions – S/N-003 blade.

tested for 1,420,000 cycles at this condition. Second, the hydraulic actuator was moved outboard to attach to the blade tip clevis fitting at BS 144.

Tests were run for 580,000 cycles in this configuration to develop the loads shown by the dash-dot line in Figure 69. This same loading scheme was used for the S/N-004 blade to develop the loads shown in Figure 70. First, the loads shown by the solid lines in this figure were applied for 1,950,000 cycles. Then the loads were increased 20 percent (to a level 56 percent greater than the 540 blade maximum level flight loads) as indicated by the dash line.

The data from the fatigue tests of the S/N-002, -003, and -004 blades were used to develop the load/cycle fatigue curves shown in Figures 71 through 78, which established the endurance limit loads for the ground and flight tests. No blade failures were encountered during these laboratory tests as a result of the fatigue loads that were applied -- all test points were "run-outs." The blades maintained the same natural frequencies throughout the tests. The pre- and post-test strain gage calibrations were unchanged. These factors, plus visual inspection, indicated that the blades had encountered no structural damage during the tests.

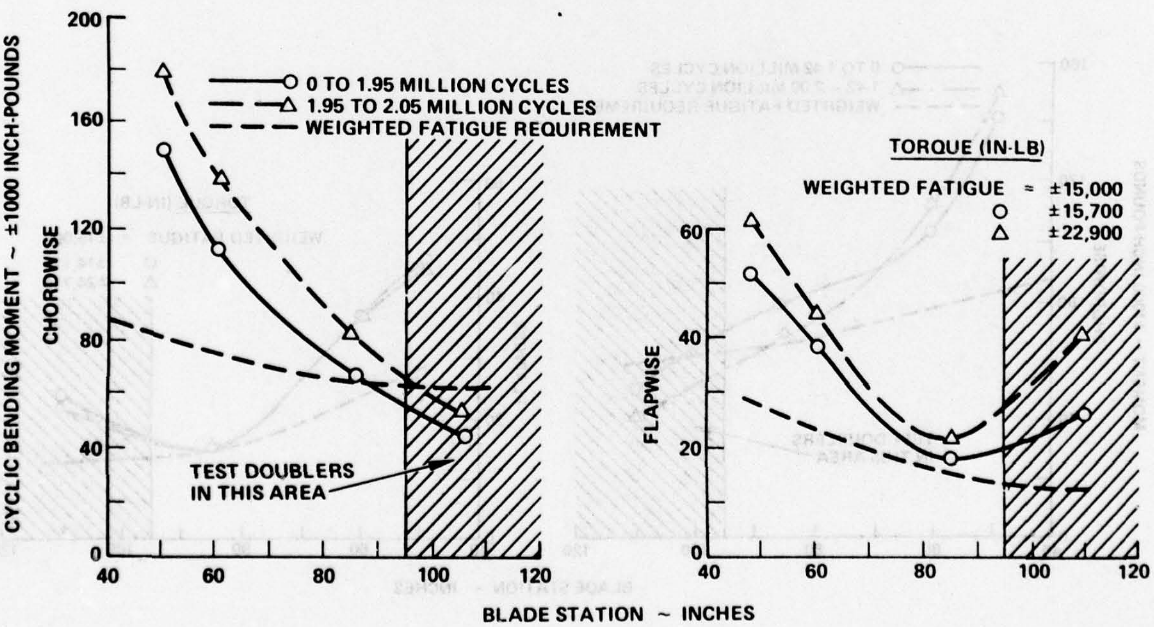


Figure 70. Fatigue test loading conditions — S/N-004 blade.

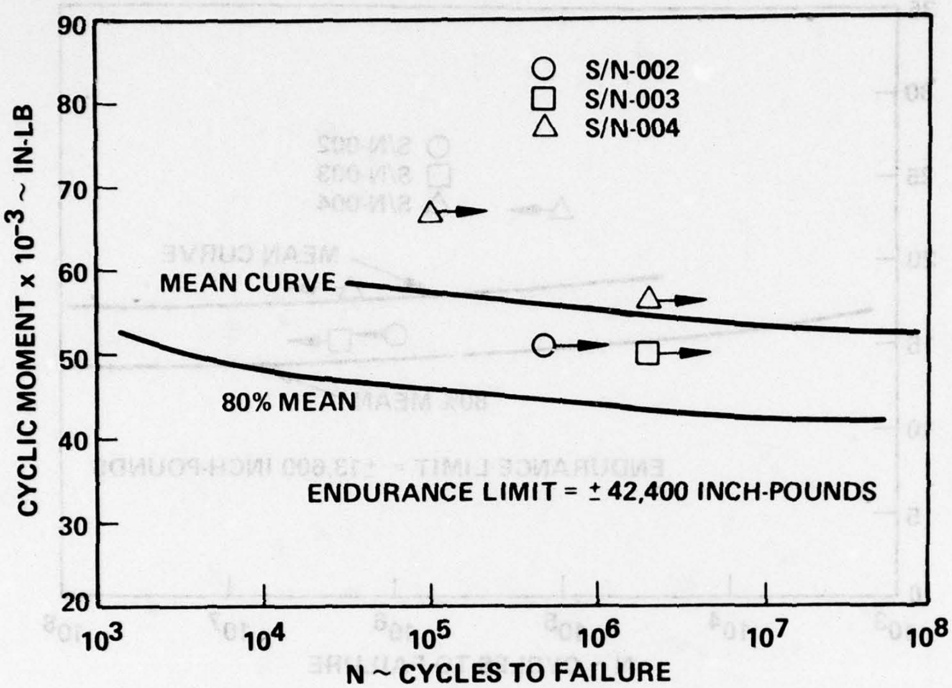


Figure 71. MTS rotor blade cyclic flapwise moment at BS 48.

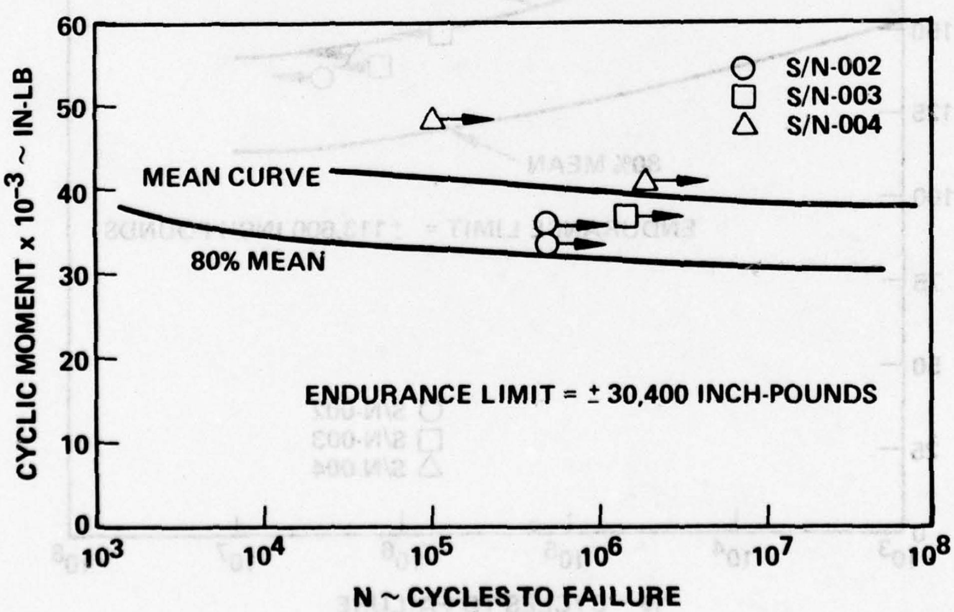


Figure 72. MTS rotor blade cyclic flapwise moment at BS 60.

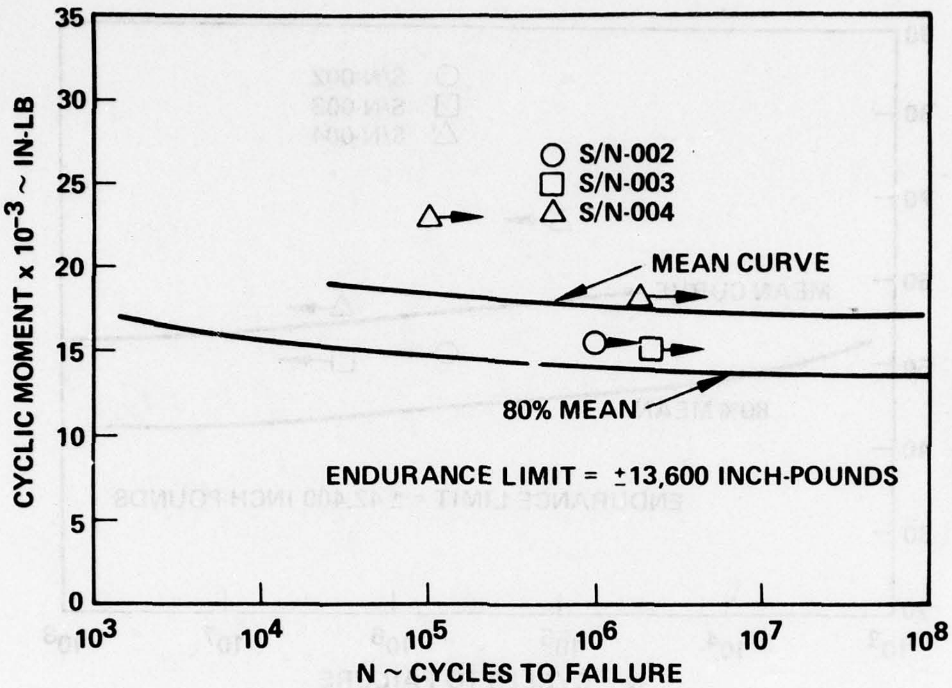


Figure 73. MTS rotor blade cyclic flapwise moment at BS 85.

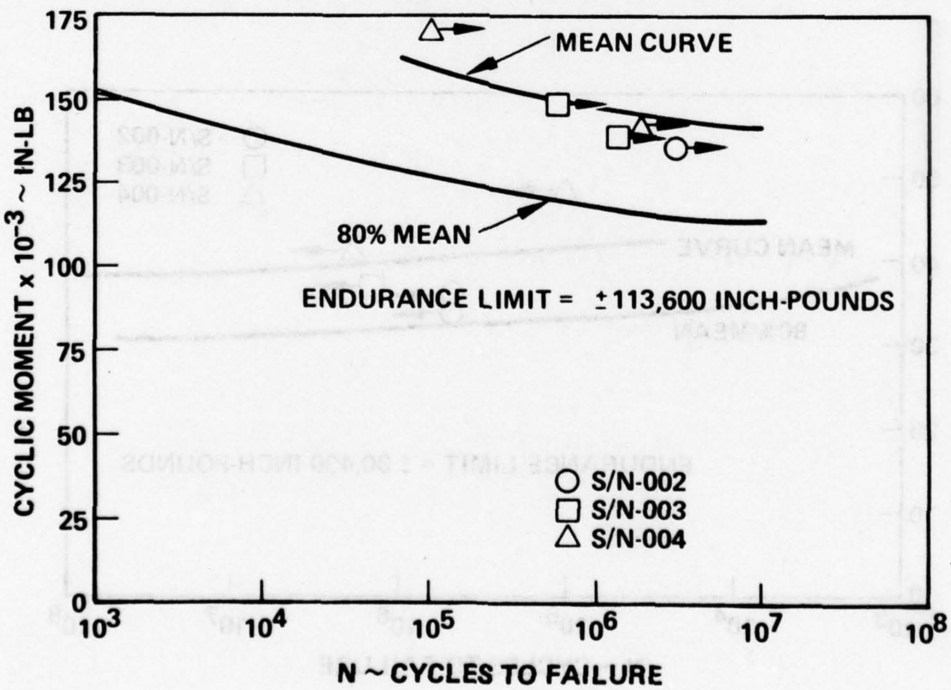


Figure 74. MTS rotor blade cyclic chordwise moment at BS 43.

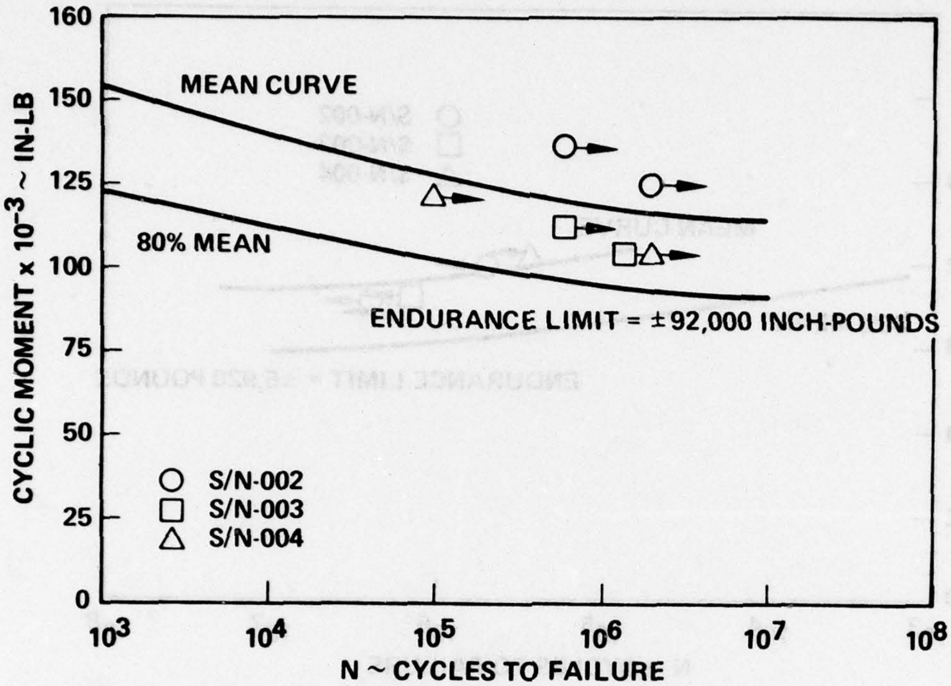


Figure 75. MTS rotor blade cyclic chordwise moment at BS 60.

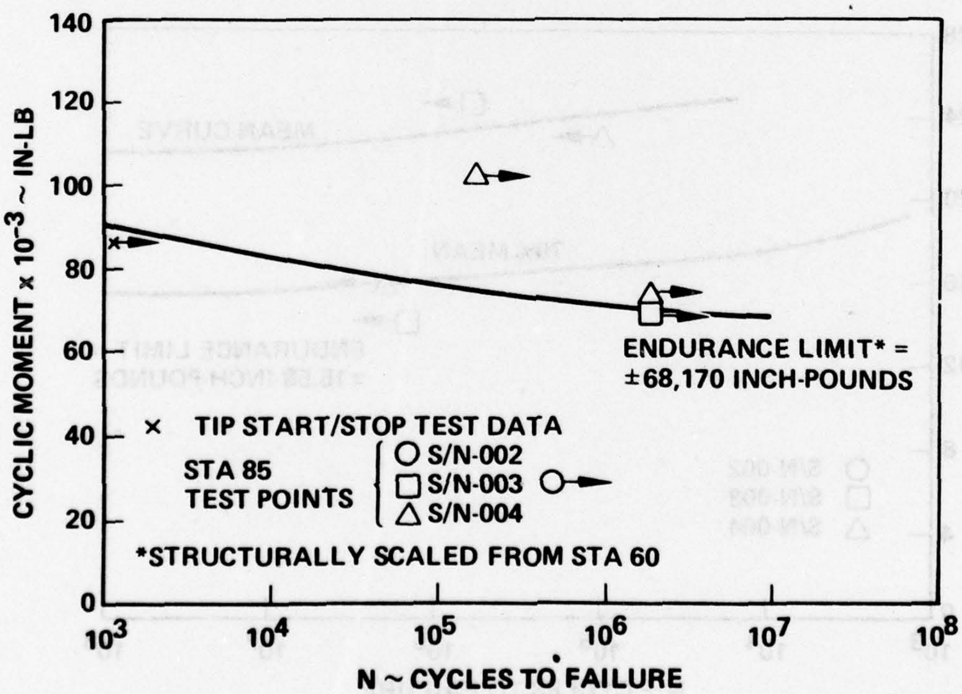


Figure 76. MTS rotor blade cyclic chordwise moment at BS 85.

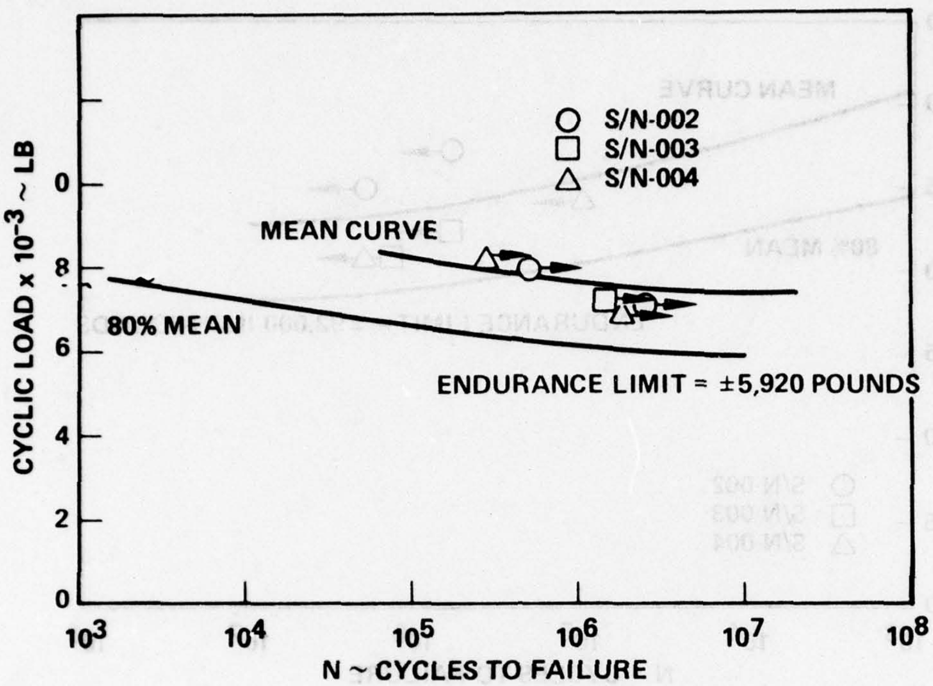


Figure 77. MTS rotor blade cyclic drag brace load.

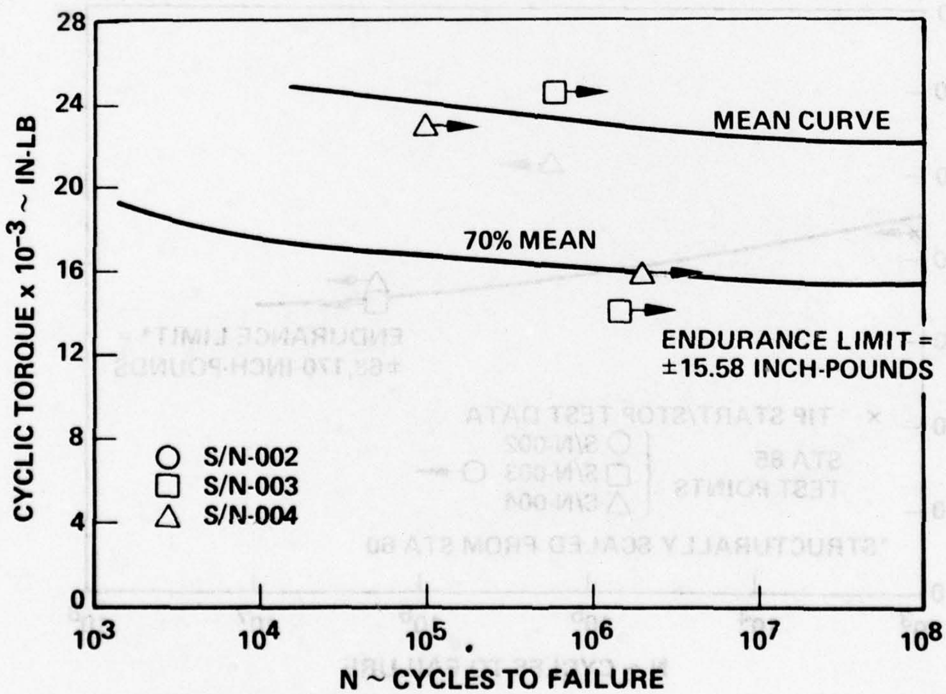


Figure 78. MTS rotor blade root-end cyclic torque.

Because of the limited data (three specimens) the "run-out" test points were not considered to have established endurance limits. The Federal Aviation Administration (FAA) factor of 20 percent reduction in allowable loads when only three specimens have been tested was applied. Hence, the lower curves in Figures 71 through 78 are representative of the endurance limits for the limited flight tests of the current program only. Before expanded flight envelope tests or service evaluation tests, additional fatigue tests must be run at loads high enough to fail the blade and determine its true endurance limit. The MTS blade is calculated to have infinite fatigue life. Additional tests are expected to prove this to be the case, and that the endurance limits recommended for the current program are extremely conservative.

The first portion of the fatigue test for the S/N-002 blade was run for 2,000,000 cycles. During a follow-on portion, the loading conditions were changed for a 1,000,000-cycle test. About halfway through this test, the centrifugal force subassembly of the fatigue fixture broke, released the 90,000-pound centrifugal force instantaneously and subjected the blade to chordwise impulse from the weight of the strap attachment clevis and blade collar. The hydraulic shaker was turned off within 26 cycles. The damage the blade sustained was a separation of the upper and lower skins from the trailing edge longo between BS 60 and 85, and a small rip in the upper aft skin at BS 90 (Figure 79). After the fatigue fixture was repaired, the damaged specimen was remounted in the test fixture and underwent the remaining 500,000 cycles of the test. The blade continued to carry the before-accident loads at the same frequency, indicating that it had suffered no important structural damage in this accident.

Fatigue tests of the S/N-005 blade that was ballistically damaged by a 23mm HEI-T projectile are discussed in Volume III of this report.

COMPOSITE BLADE REPAIR

The S/N-002 blade also demonstrated the efficiency of an aft-blade repair technique. Prior to the root fatigue test when the tip doubler was being bonded on, the aft portion of the blade in the region of the No. 5 spar tube was inadvertently collapsed by the vacuum used to hold the tip doubler in place while the resin cured. The blade was repaired (as shown in Figure 80) by cutting out the damaged area, inserting new honeycomb panels separated by a wedge of polyvinylchloride (PVC) foam, and bonding on an overlapping skin patch, top and bottom. This repair went through the entire 3,000,000-cycle fatigue test (including the test fixture accident described above) without difficulty, and demonstrated the efficiency of this repair technique.

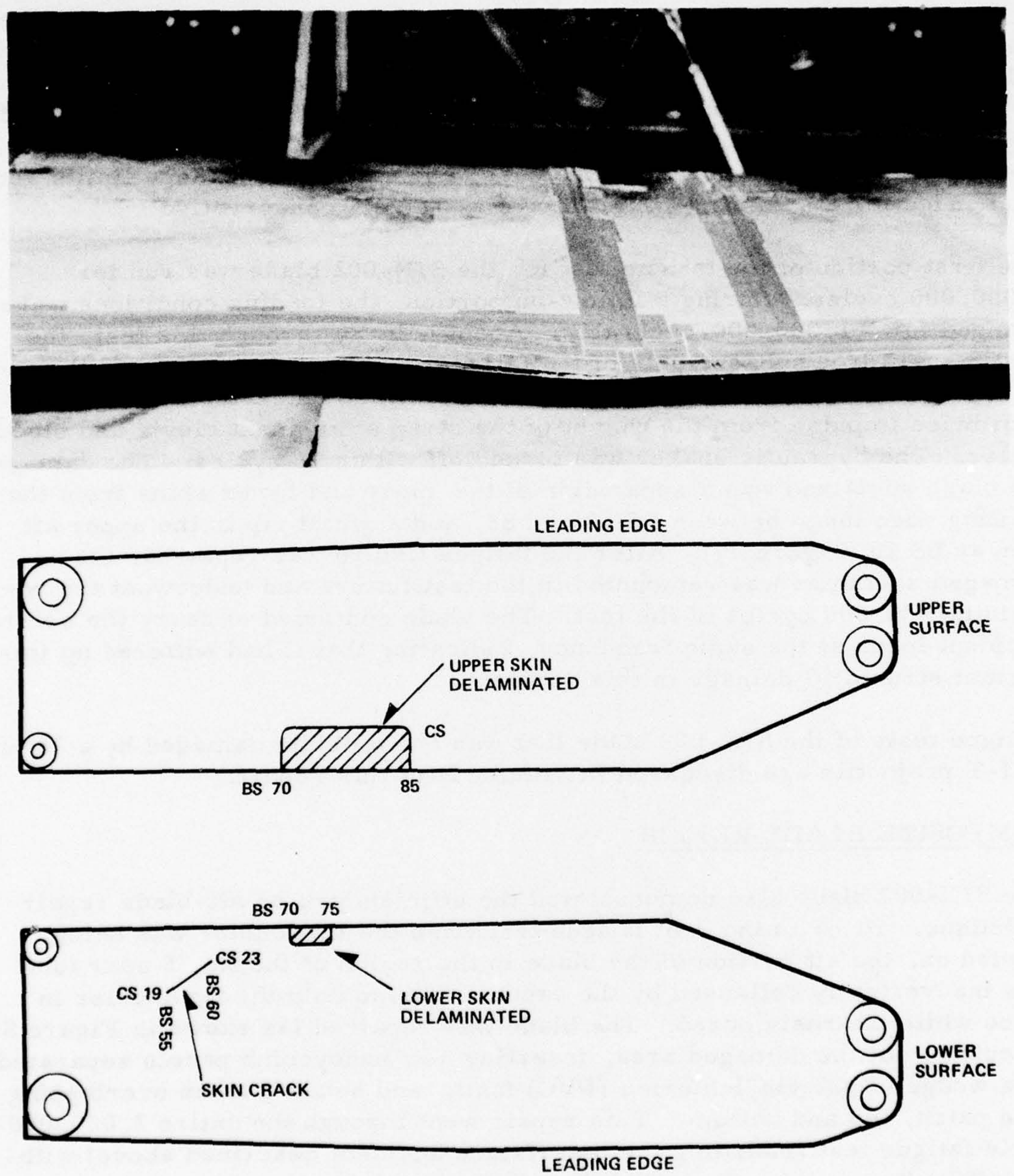


Figure 79. S/N-002 MTS blade damage resulting from fatigue fixture accident.

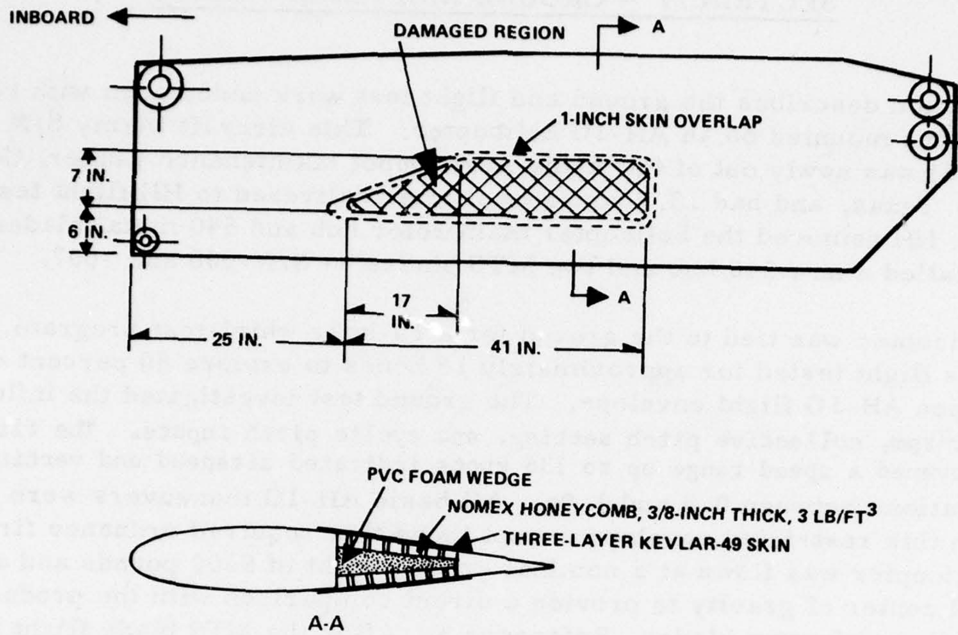


Figure 80. S/N-002 blade repair.

SECTION IV – GROUND AND FLIGHT TESTS

This section describes the ground and flight test work undertaken with two MTS blades mounted on an AH-1G helicopter. This aircraft (Army S/N 67-15683) was newly out of the Army Aero Depot Maintenance Center, Corpus Christi, Texas, and had 13.5 hours on it when delivered to HH flight test center. HH removed the helicopter main rotor hub and 540 metal blades and installed a new 540 hub and two MTS blades -- S/N-006 and -007.

The helicopter was tied to the ground for a 10-hour whirl-test program, and then was flight tested for approximately 15 hours to explore 80 percent of the production AH-1G flight envelope. The ground test investigated the influence of rotor rpm, collective pitch setting, and cyclic pitch inputs. The flight tests covered a speed range up to 136 knots indicated airspeed and vertical accelerations between 0.3 and 1.9g. All basic AH-1G maneuvers were flown in this restricted envelope except those that required ordnance firing. The helicopter was flown at a nominal gross weight of 8500 pounds and at a forward center of gravity to provide a direct comparison with the production (540) metal rotor blades, Reference 3. After the MTS blade flight test was completed, the 540 metal blades were reinstalled on the helicopter, and a short program was flown for a direct hub and mast loads comparison and for a pilot qualitative comparison of the two blade systems. The pilot reported a smoother ride with the MTS blades, but otherwise no significant differences in handling qualities. The rotor loads measured for the MTS blades were the same as or a little lower than those for the 540 blades.

INSTRUMENTATION

The instrumentation equipment listed in Table 10 was installed in the helicopter and on one of the MTS blades (S/N-007). Strain gage bridges were used to measure forces and moments, potentiometers measured positions, accelerometers measured accelerations, and transducers measured engine torque and airspeed. A 61-circuit slipring transferred signals out of the rotor and a 50-channel oscillograph recorded all data. An oscilloscope in the forward cockpit allowed the flight test engineer to monitor the alternating portion of five selectable load parameters (two at a time) during flight. In this way, he could have a real-time assessment of critical loads and did not have to wait for the oscillograph paper to be developed and analyzed. Control position

TABLE 10. INSTRUMENTATION LIST

Parameter		Galvanometer Frequency Response (Hz)
Rotor Blade Flapwise Bending Moment - MTS Blade (S/N-007) only	- BS 48	135
	- BS 60	135
	- BS 85*	135
	- BS 110	135
	- BS 180	135
	- BS 220	135
Rotor Blade Chordwise Bending Moment - MTS Blade (S/N-007) only	- BS 48	135
	- BS 85*	135
	- BS 180*	135
Rotor Blade Torsion - MTS Blade (S/N-007) only	- BS 85	135
	- BS 180	135
Rotor Blade Drag Brace Axial Force		30
Rotor Blade Pitch Link Axial Load*		135
Hub Flexure Flapwise Bending Moment		135
Hub Flexure Chordwise Bending Moment		30
Rotor Mast Bending Moment - 0° (In line with Blade)		135
Rotor Mast Bending Moment - 90°		135
Rotor Mast Torque		30
Accelerometer at CG - Low Frequency Vertical		6
Lateral Control Actuator Axial Force		30
Lift Link Axial Force		30
Main Rotor Teeter Angle*		135
Engine Torque Pressure**		135
Lateral Stick Position**		600
Longitudinal Stick Position**		600
Collective Stick Position**		600
Pedal Position**		600
Rotor Aximuth Position		600
Accelerometer at CG - Vertical		30
Accelerometer at CG - Lateral		30
Accelerometer at CG - Longitudinal		30
Accelerometer at Pilot Seat - Vertical**		30
Accelerometer at Pilot Seat - Lateral		30
Accelerometer at Pilot Seat - Longitudinal		30
Indicated Airspeed		135

* Selectable on cockpit monitor, two at a time.
**Oscillograph and Cockpit Display.

indicators in the pilot's cockpit showed main rotor cyclic and collective pitch and tail rotor pitch. Figure 81 shows the special cockpit instrumentation and Figure 82 shows the oscillograph and its associated equipment located in the helicopter ammunition bay.

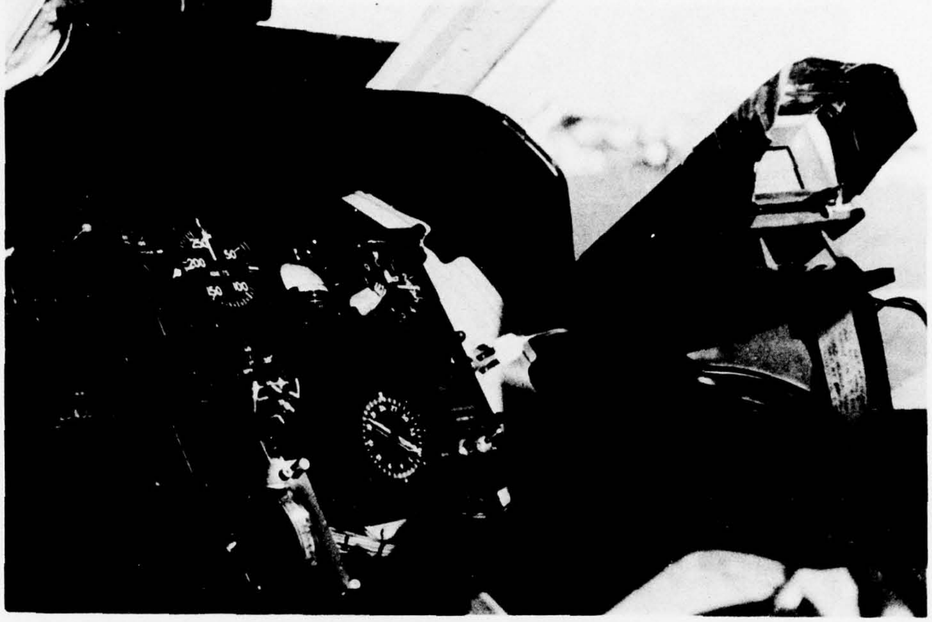
GROUND/WHIRL TESTS

The two MTS blades used for these tests were weighed and balanced individually, and made to match each other by adjusting the tip weights. The blades were mounted on a 540 hub and the whole assembly was balanced on a specially strengthened Army Balancing Kit (NSN 4920-00-572-0987). When the rotor was mounted on the helicopter, a Chadwick-Helmuth tracker/balancer (model 33A) was used to adjust the rotor track and balance. Minimum adjustments were needed and, once made during the ground tiedown test, did not have to be changed for the ground or flight tests. The flight test engineer, using the Chadwick-Helmuth strobe light blade tracker, reported that the blades tracked within 0.10 inch except for a few maneuvers in which one blade flew as much as 0.25 inch higher than its mate.

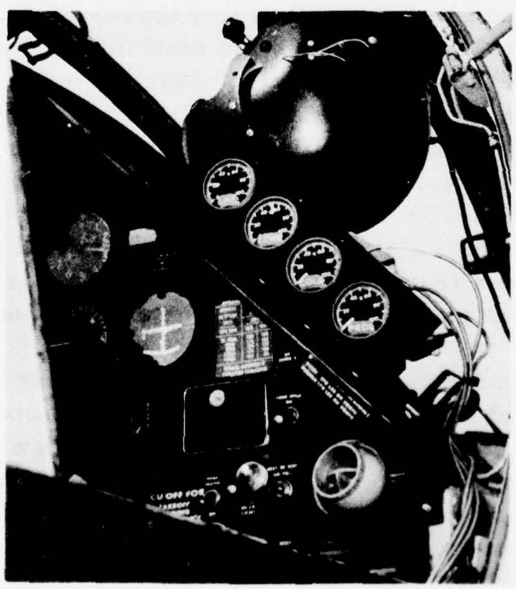
The helicopter was tied to a concrete pad as shown in Figure 83. The landing skids were clamped by U-bolts to a steel framework which in turn was bolted to the pad. This connection restrained the helicopter from moving horizontally and served to resist lateral, longitudinal, and directional moments. A large turnbuckle was the main lift tiedown link between the helicopter and the pad; it extended from an anchor buried in the concrete pad to a fitting in the helicopter directly below the lift link that connects the transmission to the airframe. A crossbar replaced the horizontal tail and its ends were tied to the ground by cables to restrain pitching moments. Lateral cables attached to the tail skid compensated for rotor torque. Torque compensation was aided by the pilot holding the two pedals in fore-and-aft alignment at all times. An arched steel bar over the cockpit was anchored to the basic steel framework under the helicopter. This was designed to give crew protection from a badly out of track rotor blade.

The ground tests gradually built up from low rpm and pitch conditions to larger and larger values until the rotor ran at maximum rated torque (50 psi) at design rpm (324) and was cycled through as much as 20 percent forward longitudinal cyclic pitch and 20 percent right lateral cyclic pitch. (Aft longitudinal and left lateral cyclic pitch were avoided because of the cable tiedown system that could not restrain the moments developed by these pitch inputs.)

The 10-hour ground test followed the schedule in Appendix D, Table D-1. All rotor loads were well below their endurance limits, as would be anticipated for a tiedown test of this type.



Forward Cockpit, Showing Oscilloscope Monitor



Aft Cockpit, Showing Control Angle Indicators

Figure 81. Special cockpit instrumentation.

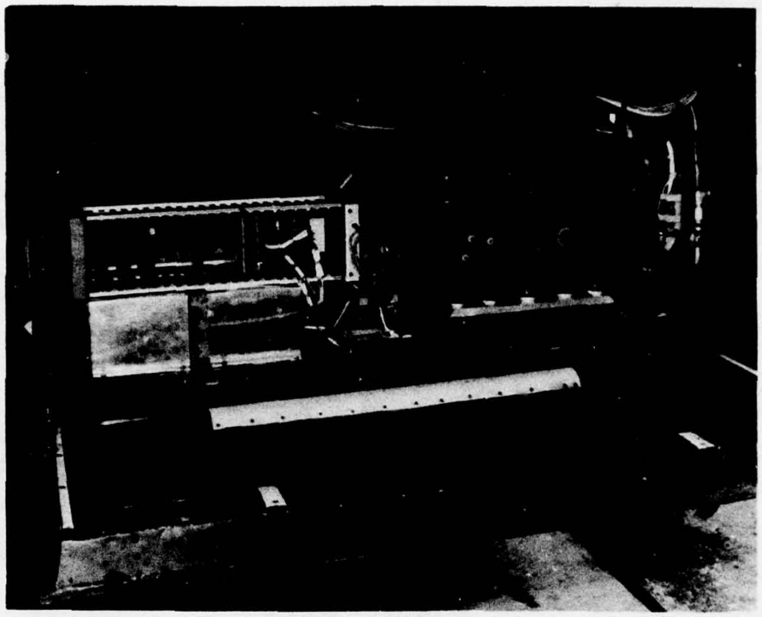


Figure 82. Oscillograph equipment in helicopter ammunition bay.

The data from the ground test is plotted in Figures 84 through 91. They show the mean loads for the various blade stations as functions of the mean lift link load; the spanwise distribution of mean flapwise bending moment, mean chordwise bending moment, and mean torsion moment; the cyclic blade loads at each station as a function of the resultant cyclic bending moment in the rotor mast; and the rotor mast cyclic bending moments in the plane of the rotor blade span axis with those in the plane perpendicular to the blade span axis. In these plots the MTS blade load limits and the maximum measured maneuvering loads (Reference 3) for the 540 rotor are tabulated to show that the MTS blade ground run loads are all well below any limits.

With the exception of one run, all the ground tests were made with the helicopter Stability/Control Augmentation System (SCAS) operating. The effect can be seen by comparing the data points shown as open symbols (SCAS "on") with those shown as solid symbols (SCAS "off"). SCAS in this helicopter includes not only the usual rate gyros but also a "feed-forward" cyclic stick position and stick rate augmentation circuit. With the helicopter tied to the ground, the gyros could not influence the control system, but the "feed-forward" function could. Figure 92 shows what typically happens in the tie-down mode with SCAS "on" and "off". With SCAS "on", as much as 12 percent more cyclic pitch input than called for by the control stick can be

Figure 83. Ground/whirl test installation.

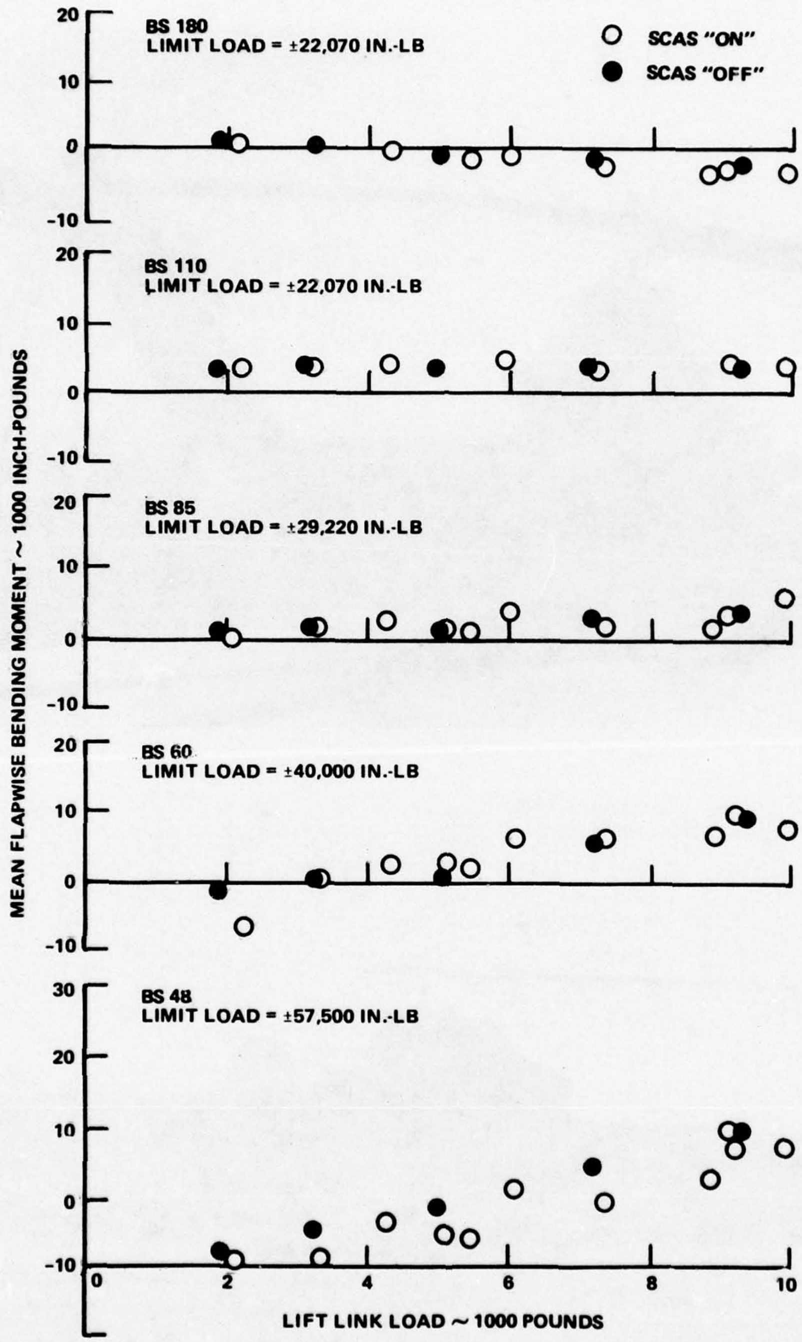


Figure 84. Mean flapwise bending moment versus lift link load, 324 rpm ground test.

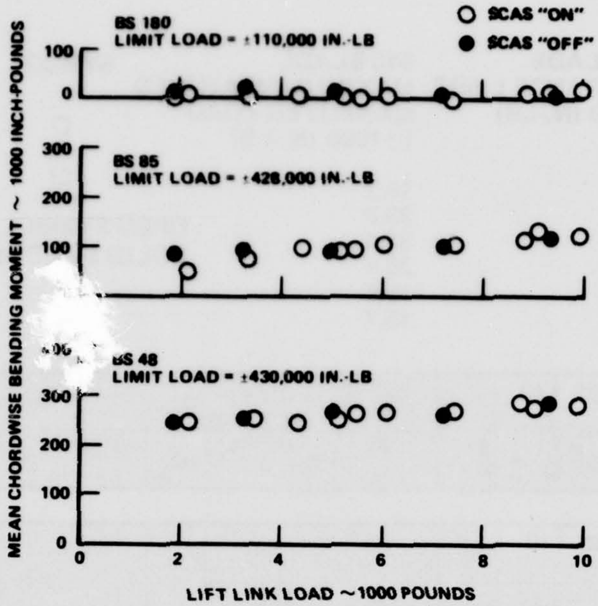


Figure 85. Mean chordwise bending moment versus lift link load, 324 rpm ground test.

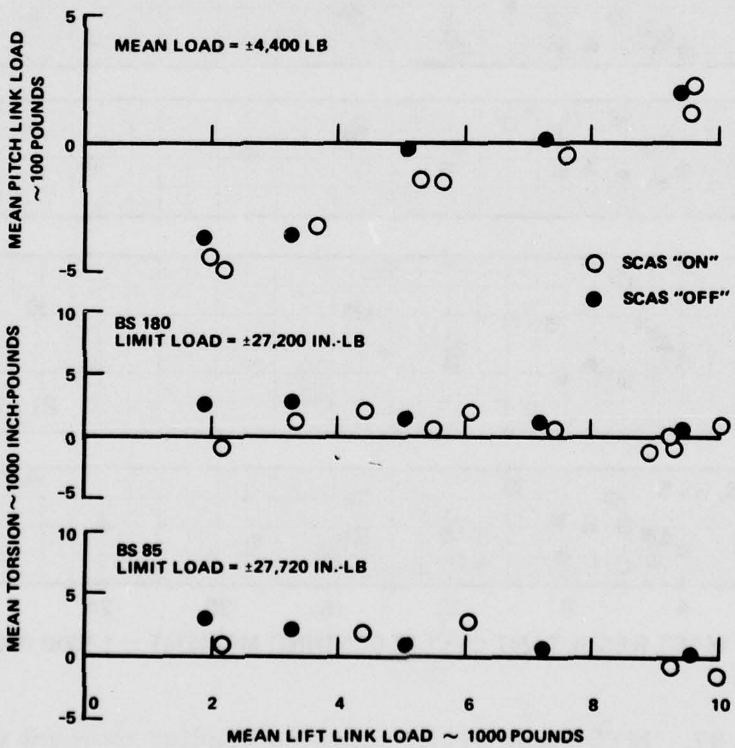


Figure 86. Mean pitch link load and mean torsion versus lift link load, 324 rpm ground test.

BLADE STATION	MTS BLADE ENDURANCE LIMIT (±1000 IN.-LB)	540 BLADE MAXIMUM MEASURED MANEUVER LOAD (±1000 IN.-LB)
5	–	16.2
48	40.8	39.0
60	29.6	31.1
85	13.1	20.9
110	13.1	15.6
180	13.1	15.7

SYMBOL	COLLECTIVE PITCH
○	0 PERCENT
△	20 PERCENT
□	40 PERCENT

OPEN SYMBOL ~ SCAS "ON"
SOLID SYMBOL ~ SCAS "OFF"

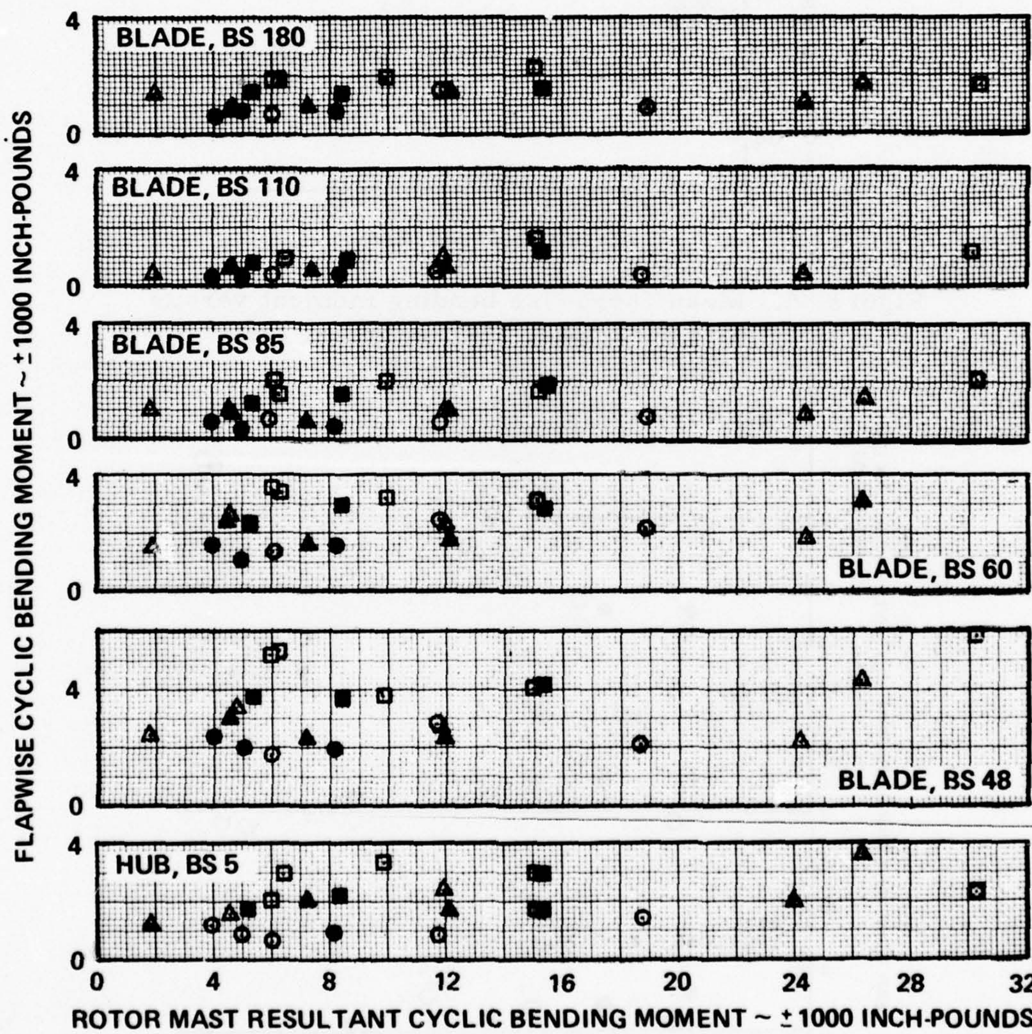


Figure 87. MTS blade cyclic flapwise bending moment versus rotor mast cyclic bending moment at 324 rpm.

BLADE STATION	MTS BLADE ENDURANCE LIMIT (±1000 IN.-LB)	540 BLADE MAXIMUM MEASURED MANEUVER LOAD (±1000 IN.-LB)
8	–	175.3
48	116.4	153.0
85	55.0	117.2
180	31.8	43.7

SYMBOL	COLLECTIVE PITCH
○	0 PERCENT
△	20 PERCENT
□	40 PERCENT

OPEN SYMBOL ~ SCAS "ON"
OPEN SYMBOL ~ SCAS "OFF"

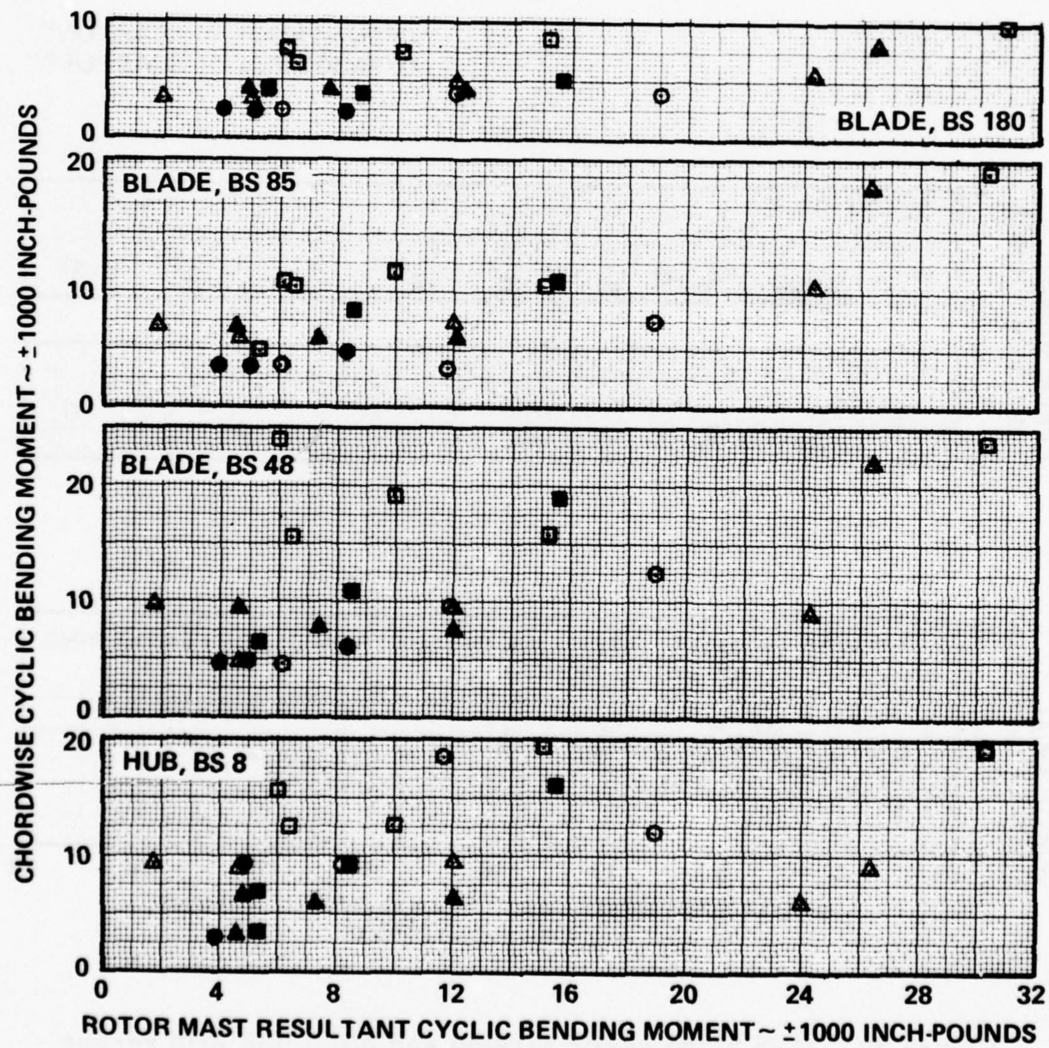


Figure 88. MTS blade cyclic chordwise bending moment versus rotor mast cyclic bending moment at 324 rpm.

BLADE STATION	MTS BLADE ENDURANCE LIMIT	540 BLADE MAXIMUM MEASURED MANEUVER LOAD
PITCH LINK	±1580 LB	±3150 LB
84	±14,700 IN.-LB	±19,830 IN.-LB
180	±11,130 IN.-LB	——

SYMBOL	COLLECTIVE PITCH
O	0 PERCENT
Δ	20 PERCENT
□	40 PERCENT

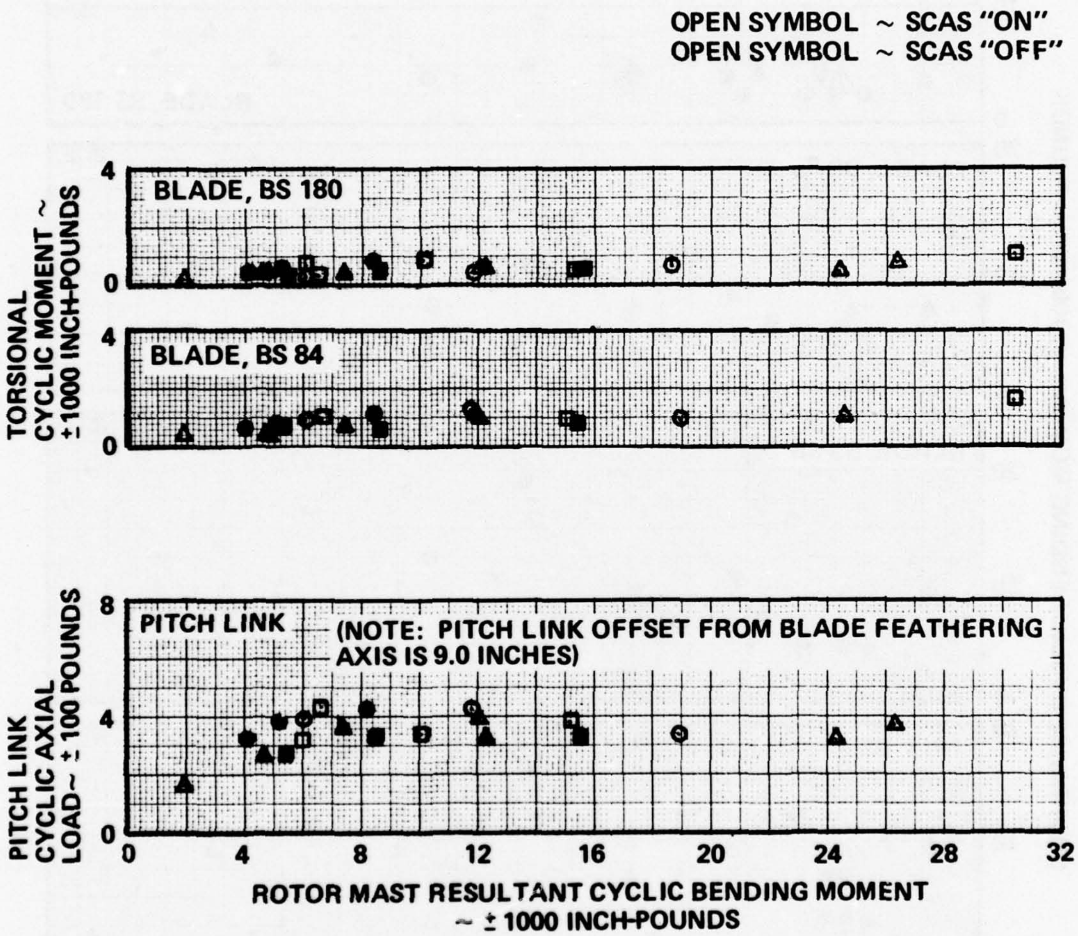


Figure 89. MTS blade cyclic torsion and pitch link load versus rotor mast bending moment at 324 rpm.

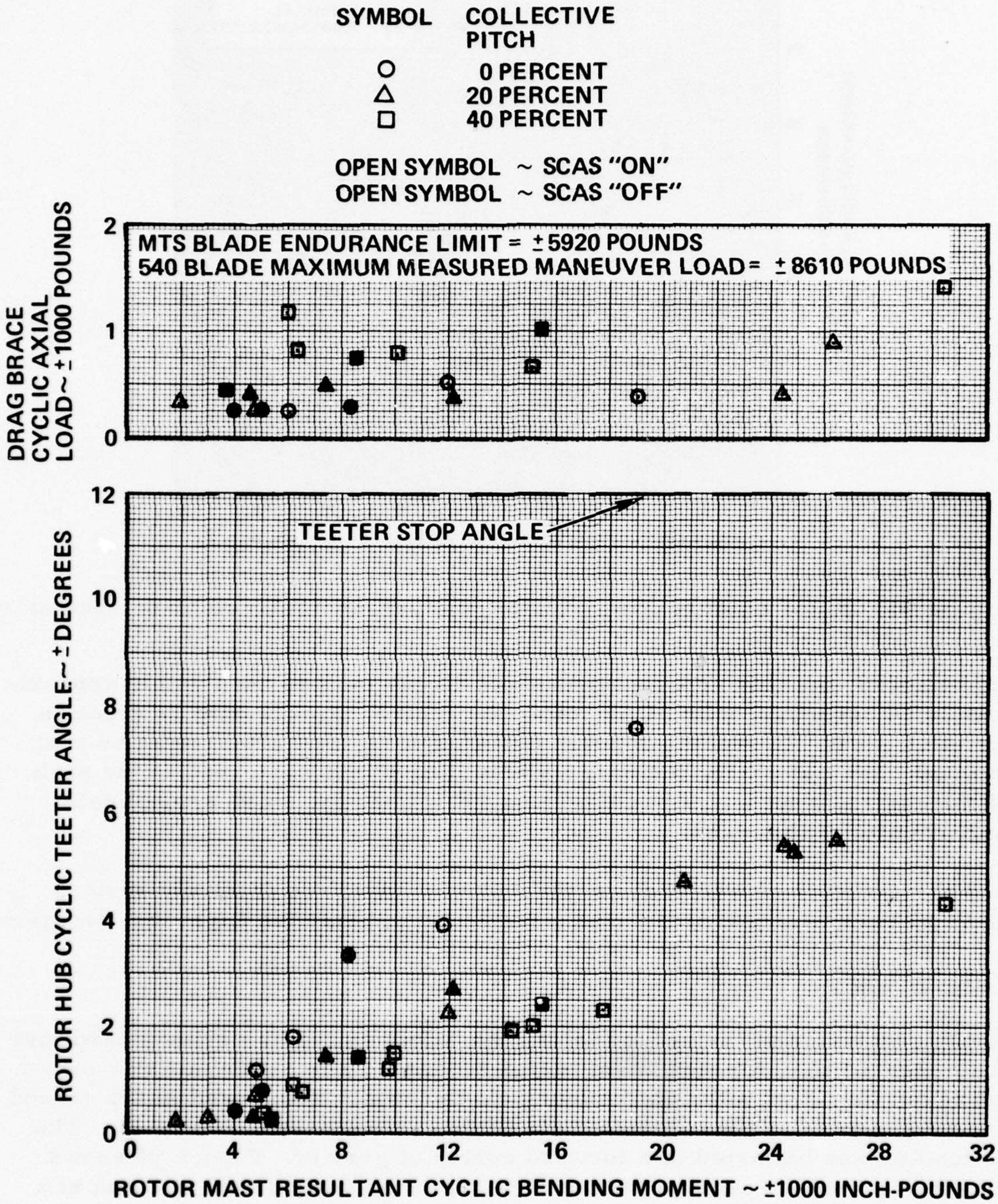


Figure 90. Drag brace load and teeter angle versus rotor mast bending moment at 324 rpm.

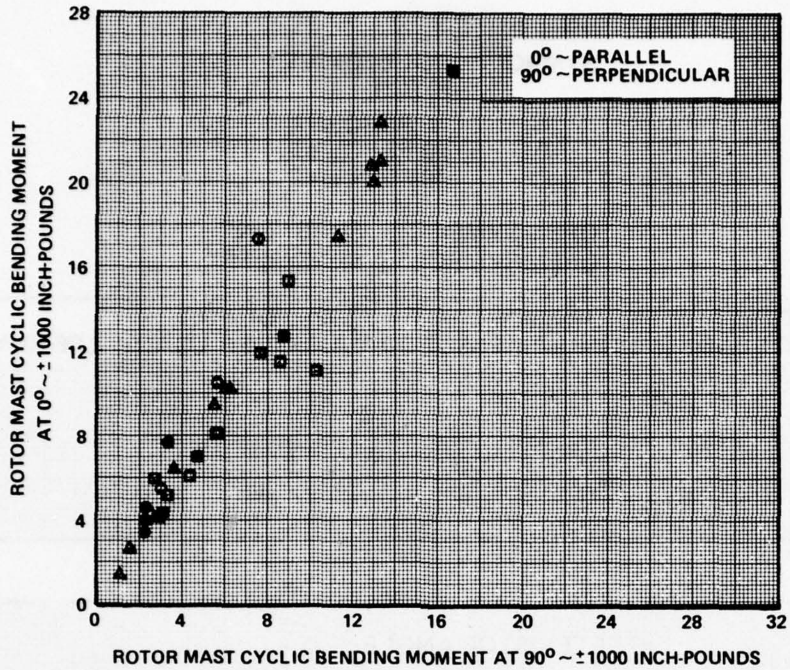


Figure 91. Rotor mast bending parallel and perpendicular to blade span axis.

experienced, but this apparent overshoot bleeds back to zero within approximately 10 seconds. With SCAS "off", the control input is only as great as the stick input. In reading Figures 84 through 91, this effect must be kept in mind when comparing the open-symbol data which were read at the peak of the control input (stick position-plus-SCAS) and the solid-symbol data (control stick input only).

The ground tests showed that the MTS blades were free from any serious loads or dynamics problems, and were ready to begin the flight test program.

FLIGHT TEST

At the conclusion of the ground tests, the Safety of Flight Review Board met and approved the proposed flight test procedure. The helicopter was prepared for the flight tests by removing all tiedown fixtures used in the ground tests and returning the aircraft to its flight configuration, Figure 93. The helicopter was ballasted to a forward center of gravity. Figure 94 shows that the cg was at Fuselage Station (FS) 192.4 for takeoff with full fuel at a gross weight of 8685 pounds. The cg moved forward slightly as fuel burned off. All test points except those performed in ground effect were flown at

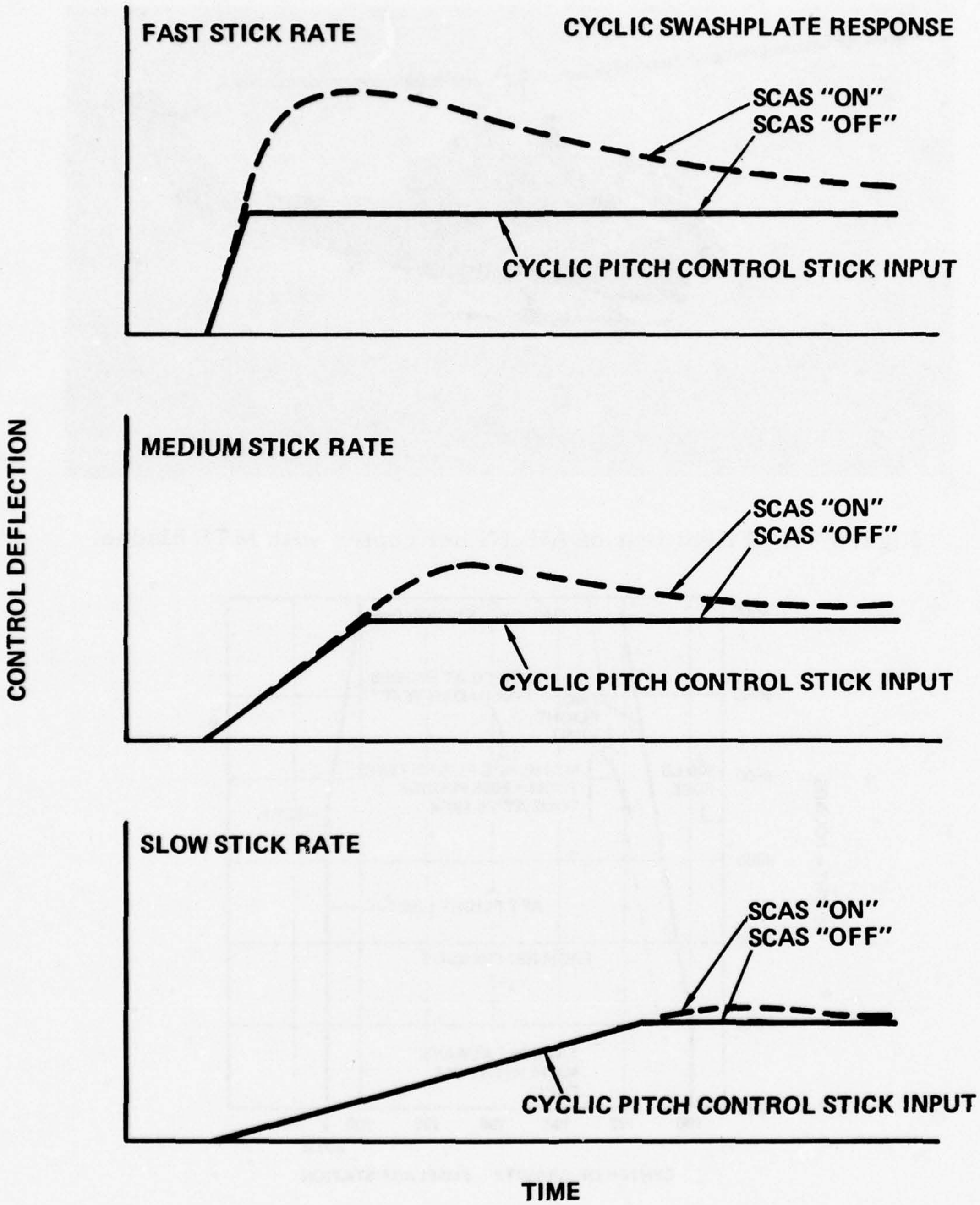


Figure 92. Schematic stability augmentation system response in helicopter tiedown mode.

Figure 93. Flight test of AH-1G helicopter with MTS blades.

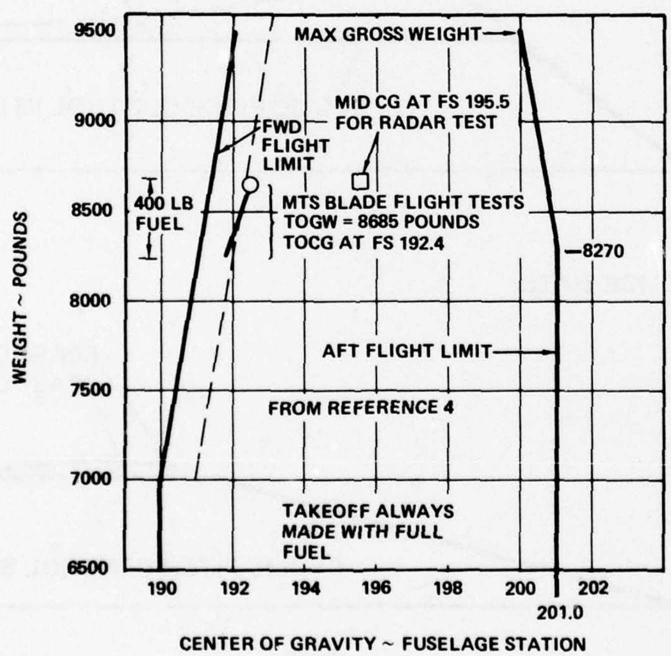


Figure 94. Center of gravity flight limits.

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[4] OPERATOR'S MANUAL, ARMY MODEL AH-1G HELICOPTER, Technical Manual 55-1520-221-10, Headquarters, Department of the Army, Washington, D.C., 12 December 1975, p. 7-6.

4000 feet pressure altitude. These conditions were chosen to expedite comparison with flight test data for the production metal (540) blades (Reference 3).

The flight tests were performed in a gradual buildup manner until 80 percent of the AH-1G flight envelope had been explored:

a. 10 knots rearward to 136 knots forward

b. 24 knots sideward flight

c. Vertical accelerations between 0.3 and 1.9g

This required 21 flights whose test points are summarized in Appendix E, Table E-1. The airspeed/acceleration envelope that was explored in this program is shown in Figure 95.

A set of endurance limit loads for the MTS blade was established on the basis of the rotor blade fatigue tests, and on the hub, mast and controls information from the helicopter manufacturer. These limits are listed in Appendix E, Table E-2 along with 10-hour and 1-hour load limits. Appendix E, Table E-3 defines interaction equations that relate hub and mast

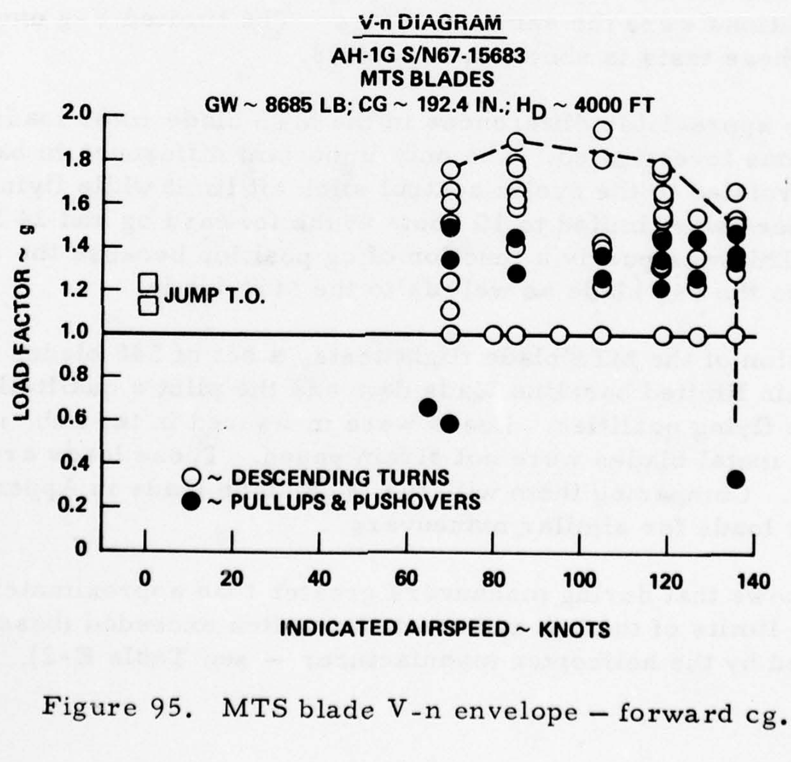

Figure 95. MTS blade V-n envelope — forward cg.

loads, and sets limits for these conditions. The MTS blade endurance limits were extremely conservative, but were exceeded during only 62 cycles in this test. The cumulative damage to the blade, actual cycles over endurance limit/allowable cycles over endurance limit = 0.0782, is insignificant.

The 50-channel oscillograph recorded the quantities listed in Table 10 during flight. The flight test engineer could monitor five of these in real time on the oscilloscope in his cockpit. Hub teeter angle was always shown on the scope. He could select any one of the other four: flapwise bending at BS 85, chordwise bending at BS 85 and at BS 180, and pitch link axial force. Usually he monitored chordwise bending at BS 85 because that was the blade parameter that ran nearest to the endurance limit.

A summary of the MTS blade loads is given in Figures 96 and 97 for level flight and for turns. The 540 blade loads, Reference 3, are superimposed for comparison. The loads are seen to be similar for the two types of blades, with the MTS blade loads being just a little lower. Appendix E lists all the MTS blade test data in tabular form and in plotted form. The loads reported here are the maximum loads encountered during the maneuvers--they did not necessarily occur at the maximum g condition, but usually during recovery.

Appendix F presents a tabulation of supplementary data taken in preparation for a radar cross section test in which the cg was in a midlocation (FS 195.5). All other conditions were the same as before. The limited V-g envelope investigated in these tests is shown in Figure 98.

There were no appreciable differences in the MTS blade rotor loads for the two cg conditions investigated. The only important difference in handling qualities was related to the cyclic control stick aft limit while flying rearward. The speed was limited to 10 knots at the forward cg and 24 knots at the mid-cg. This was purely a function of cg position because the 10-knot limit applied to the 540 blade as well as to the MTS blade.

At the conclusion of the MTS blade flight tests, a set of 540 blades was installed to obtain limited baseline loads data and the pilot's qualitative opinion of the relative flying qualities. Loads were measured in the hub, mast, and controls — the metal blades were not strain gaged. These loads are tabulated in Appendix G. Comparing them with the MTS blade loads in Appendix E shows similar loads for similar maneuvers.

Appendix E shows that during maneuvers greater than approximately 1.6g the endurance limits of the hub and mast were often exceeded (based on limits provided by the helicopter manufacturer — see Table E-2). These

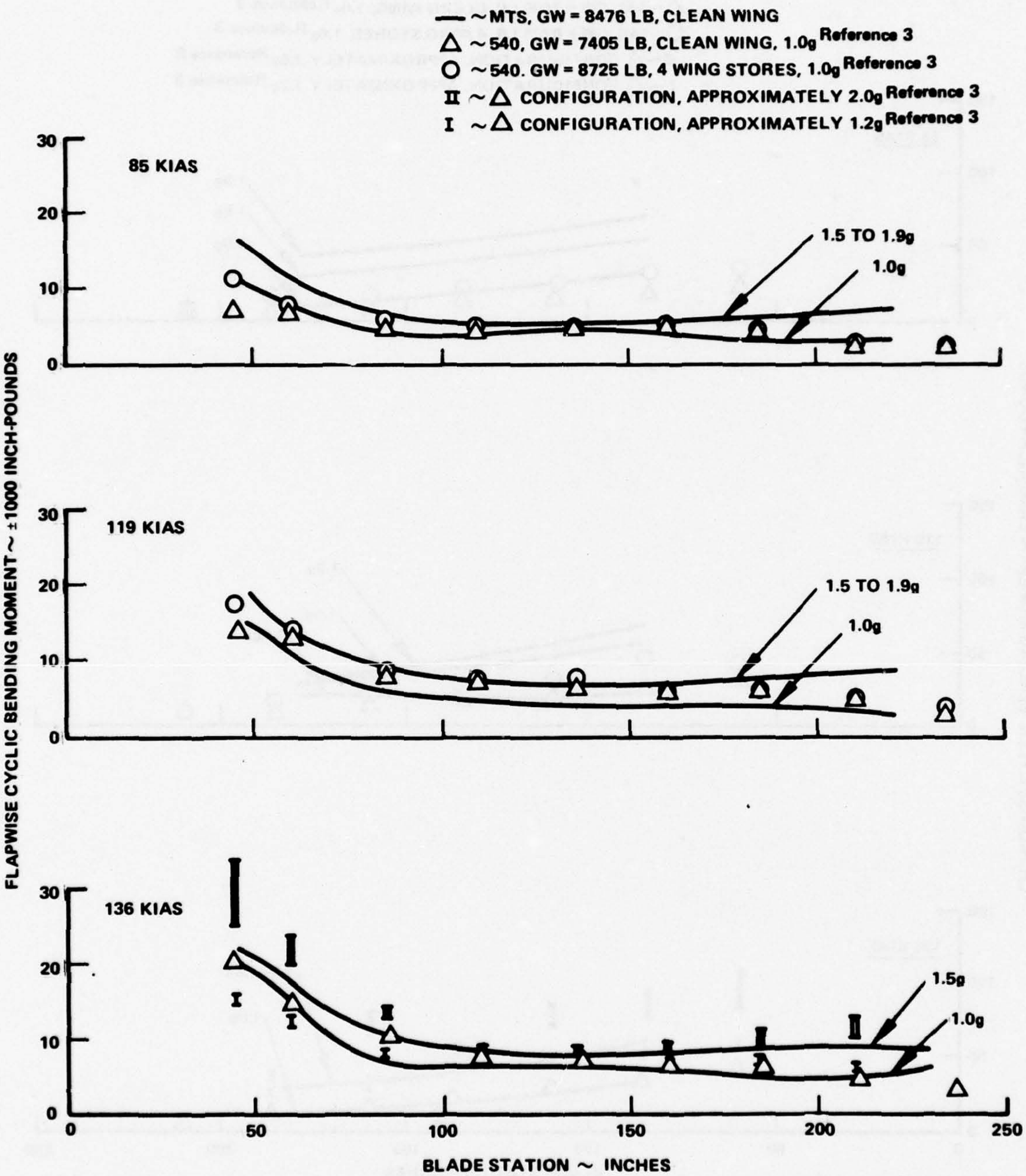

Figure 96. Flapwise bending moment comparison, MTS versus 540, CG ≈ FS 192.4.

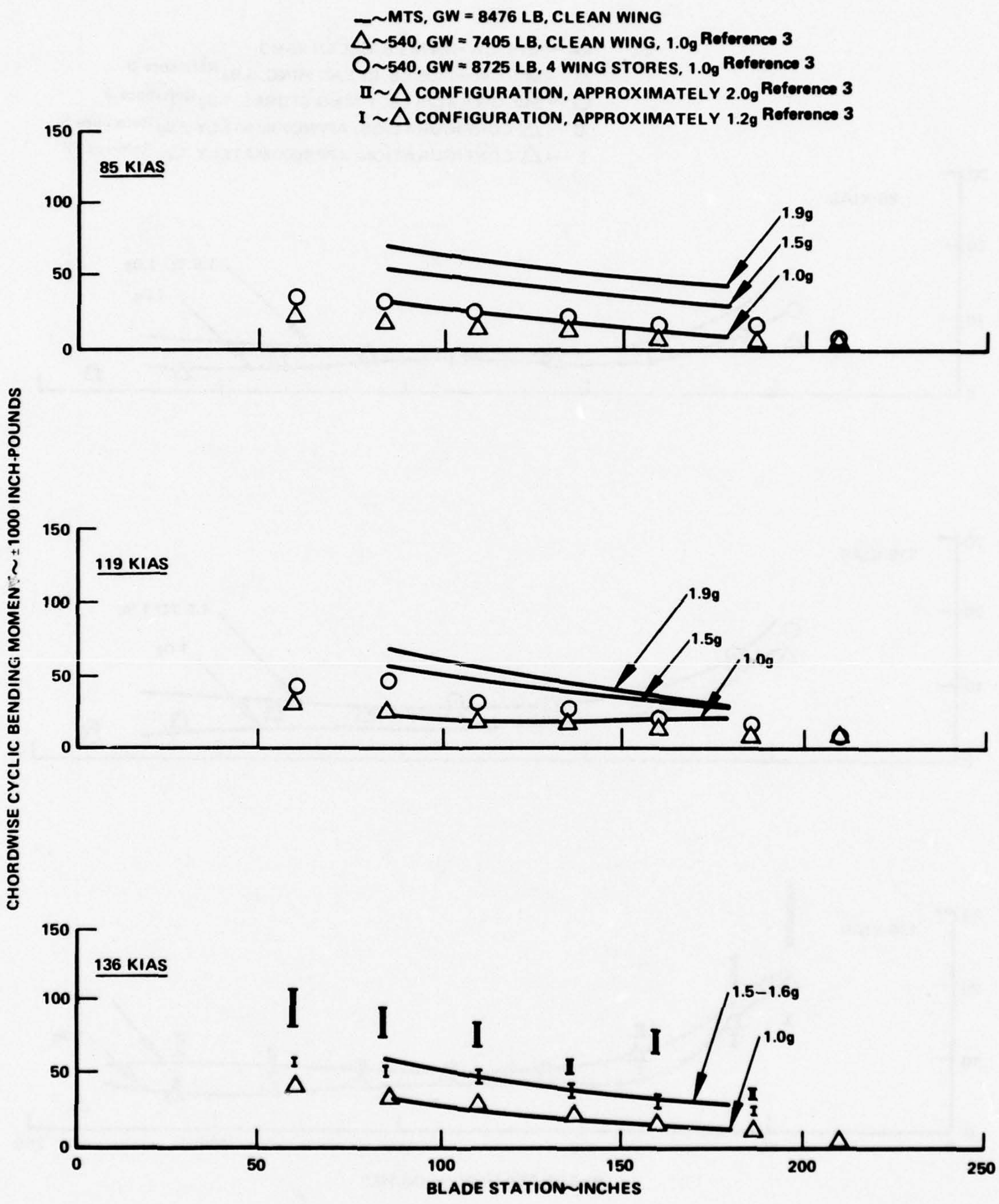

Figure 97. Chordwise bending moment comparison, MTS versus 540, CG ≈ FS 192.4.

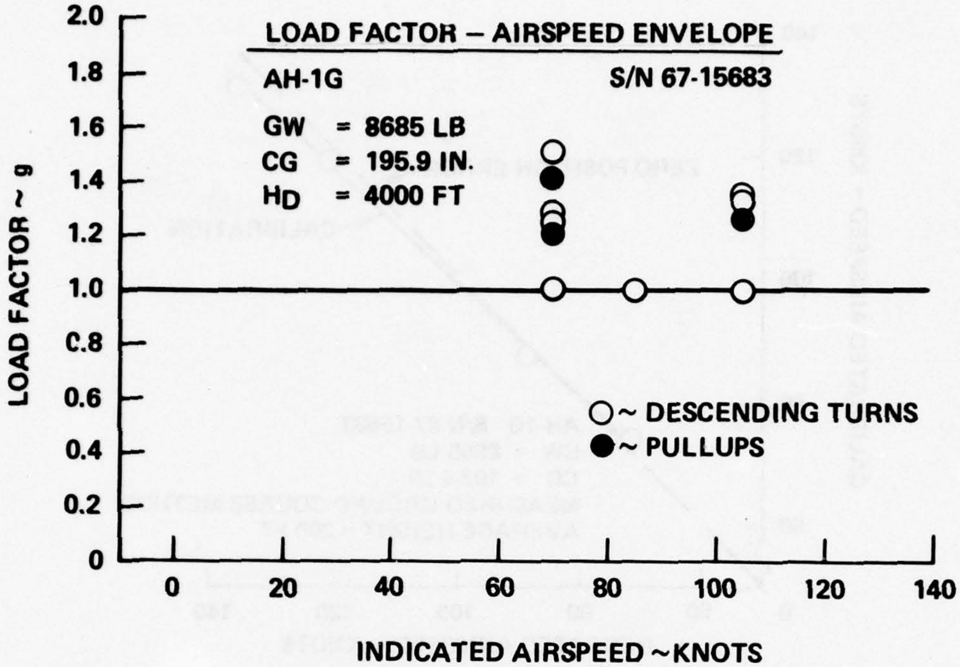

Figure 98. MTS blade V-n envelope — mid-cg.

tests conducted with the metal blades showed the same mast/hub loads, so it was concluded that the basic helicopter configuration induces damaging load cycles during moderate maneuvers.

It required 3.5 hours of ground/flight time to track and balance the 540 blades as compared with approximately 1.5 hours for each of the S/N-006/-007 and S/N-006/-008 MTS blade pairs. The latter combination was flown at the very end of the program to qualify these two blades for a radar cross section test to be performed later. In neither case was it necessary to bend the trim tabs of the MTS blade to achieve satisfactory track -- it was necessary for the metal blades. An airspeed calibration was flown with the 540 blades. It is shown in Figure 99 and applies equally to the MTS and 540 blade tests.

A comparison was made between the hovering efficiencies of the two types of blade by hovering in ground effect with the skids 2 feet off the ground. Figure 100 compares the hovering power coefficient/thrust coefficient (C_Q/C_T) ratio for the MTS and 540 blades. The power coefficient is based on main rotor mast torsion and the thrust coefficient on gross weight. Within the accuracy of the test conditions, there is no appreciable difference.

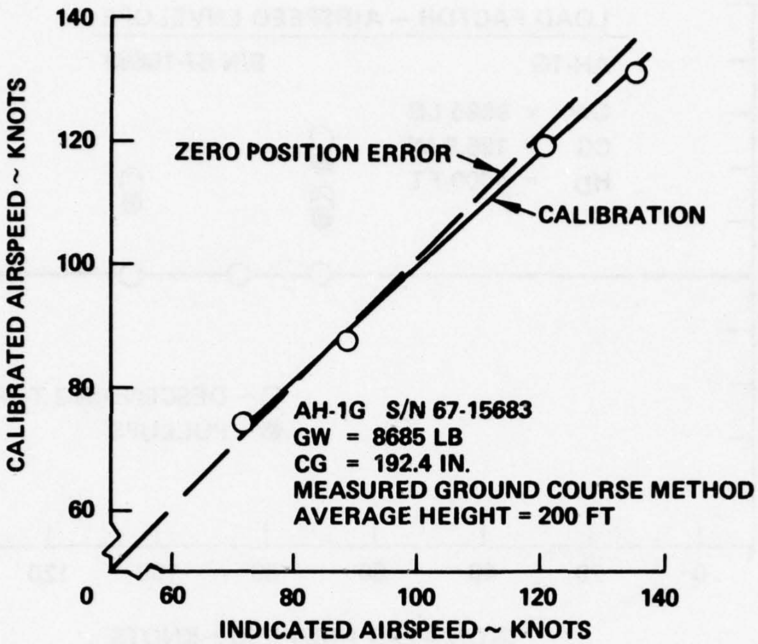

Figure 99. Airspeed calibration.

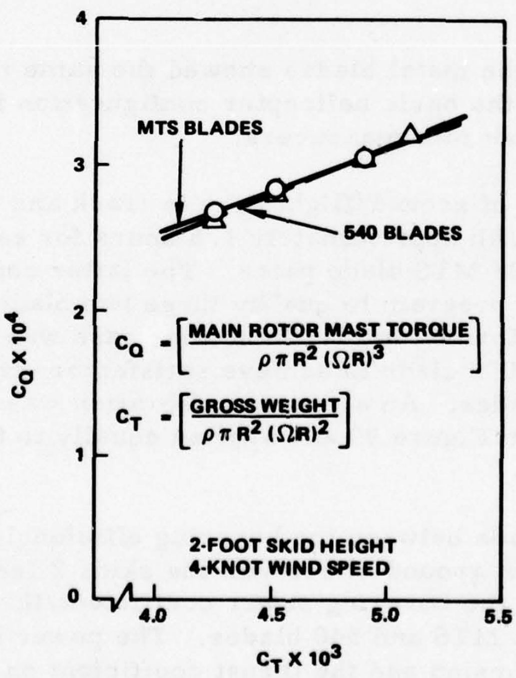

Figure 100. In ground effect (IGE) hover performance comparison — MTS versus 540 blades.

BLADE STRUCTURAL INTEGRITY

Two times during the flight test program there was a question whether the stiffness of the blade had changed significantly. The first was after Flight Number 8 whan an orange stripe was noticed on the top of the tail rotor drive shaft cover approximately in line with the orange-painted tip of the MTS blade. The second time was after the last flight when some blade surface imperfections (discussed below) were found on the S/N-007 blade. Flapwise stiffness checks were made, and no significant change was apparent either time.

The orange stripe was determined to have occurred on the ground during a hub teeter angle calibration check. Nevertheless, three 1/4-inch dowels (with their tips 6, 12, and 18 inches above the driveshaft cover) were mounted on the tail boom to indicate a close rotor approach by breaking off. None was ever broken, and the chase pilot reported that the tip of the main rotor was never seen to fly lower than the center of the tail rotor.

A procedure for inspecting the MTS blades after every ground run or flight consisted of a visual inspection of each blade and a coin-tap test of the areas shown by shading in Figure 101. Occasional surface imperfections were discovered by tapping from time to time, but were determined by HH, FSI, and Government personnel to be inconsequential with respect to safety of flight. Their appearance pointed to a case of locally insufficient bonding pressure during the resin cure cycle. In all future blades, adequate pressurization will be applied to prevent reoccurrence.

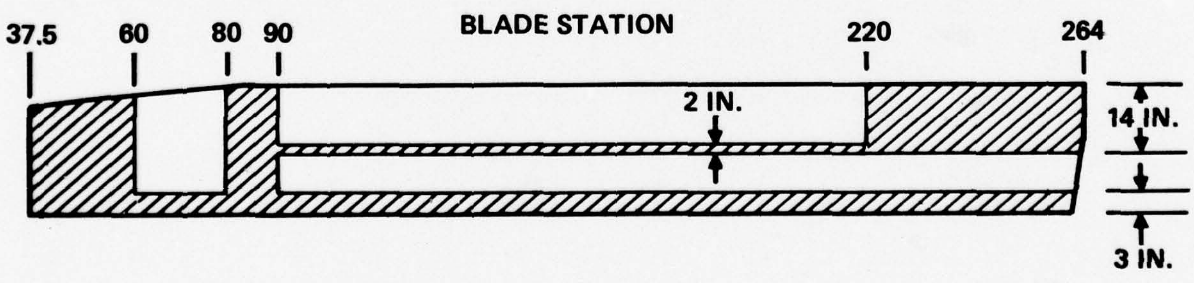

Figure 101. MTS blade tapping inspection areas.

CONCLUSION

The MTS blade program met all its goals. The design concepts integrated with the technology for fabricating the rather complex multi-tubular spar structure by the WFW, co-cure process were developed to the point where they can be reliably applied to a variety of aircraft structural components in addition to main rotor blades. The MTS blade was shown to fly like the metal blade it was designed to replace, proving that replacing a metal blade by a composite one can be routine. Its ruggedness permits it to survive severe damage (including the small explosive round threat). Tests show it to have a smaller radar cross section than the metal blade. Its leading edge erosion strip is replaceable in the field so the blade need not be discarded because of erosion damage. The stiffness, weight, and twist of the MTS type of blade, while required to match the 540 blade in this program, are readily tailorable to achieve optimum dynamics and performance. Its calculated 3600-hour fatigue life, resistance to damage, and repairability make for a longer service life than the metal blade.

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APPENDIX A

WEIGHT AND BALANCE ANALYSIS

MTS MAIN ROTOR BLADE ASSEMBLY – WEIGHT AND MASS PROPERTIES

INTRODUCTION

Design of the MTS Main Rotor Blade Assembly was developed in cooperation between Hughes Helicopters and Fiber Science, Inc. A basic requirement was to closely duplicate the mass properties of the Bell (PN 540-011-250) blade.

DISCUSSION

The weight and mass properties calculations included in this report were determined from drawings and material specifications furnished by Fiber Science. Preliminary estimates were performed to compare the mass properties of this design with the Bell blade resulting in some adjustments to the design. The report includes a comparison of the final actual MTS blade and the Bell 540 blade.

DRAWING REFERENCE

Fiber Science, Inc.

503-001	MTS Blade Assembly (Sheet 1 through 7)
503-003	Tracking Tab - MTS Blade
503-004	Bushing - Fwd Attach Fitting, MTS Blade
503-005	Bushing - Aft Attach Fitting, MTS Blade
503-007	Sleeve - Fwd Attach Fitting, MTS Blade
503-008	Sleeve - Aft Attach Fitting, MTS Blade
503-017	Nose Tip Weight, MTS Blade
503-020	Tip Weight - Adjustable, MTS Blade
503-022	Tip Weights, MTS Blade

TABLE A-1. MTS MAIN ROTOR BLADE ASSEMBLY, MASS PROPERTIES SUMMARY

Description	Hughes MTS Blade	Bell 540 Blade
Total Blade Weight (lb)	232.95	228.27
R (R Sta cg)(inches)	147.43	148.39
X (C Sta cg)(inches)	6.94	6.56
X (percent of chord)	25.7	24.3
WR (lb-in.)	34,344	33,874
WX (lb-in.)	1616.1	1497.8
WRR (lb-in.^{2})	6,464,130	6,426,052
WRR (slug-ft^2)	1,395	1,387
WRX (lb-in.^{2})	209,414	196,580
$\Sigma WRX/\Sigma WR$	6.10	5.80
Radius (feet)	22.0	22.0
Chord (inches)	27.0	27.0
Pitch Axis (percent of chord)	25.0	25.0

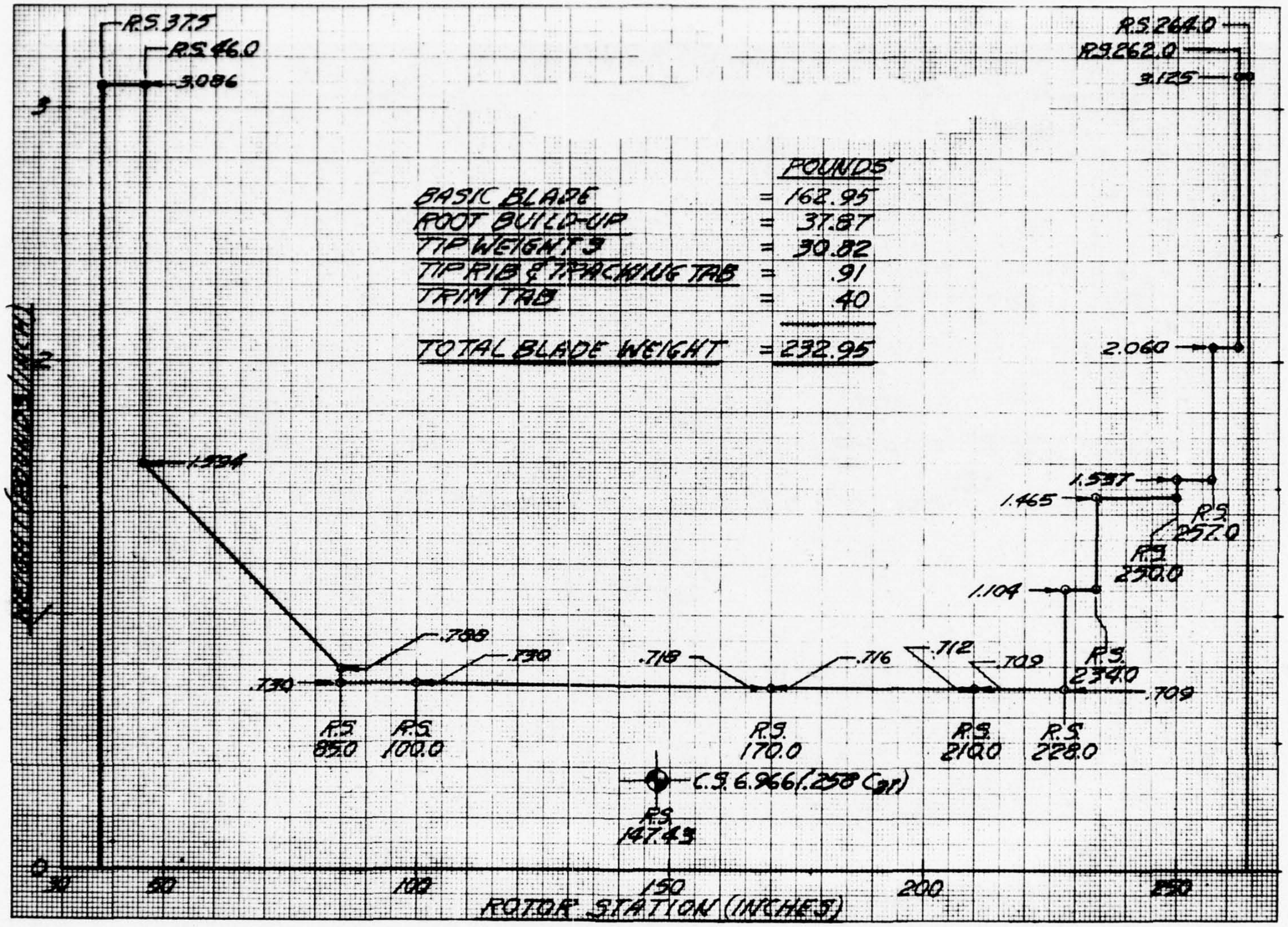


Figure A-1. MTS main rotor blade assembly, radial weight distribution.

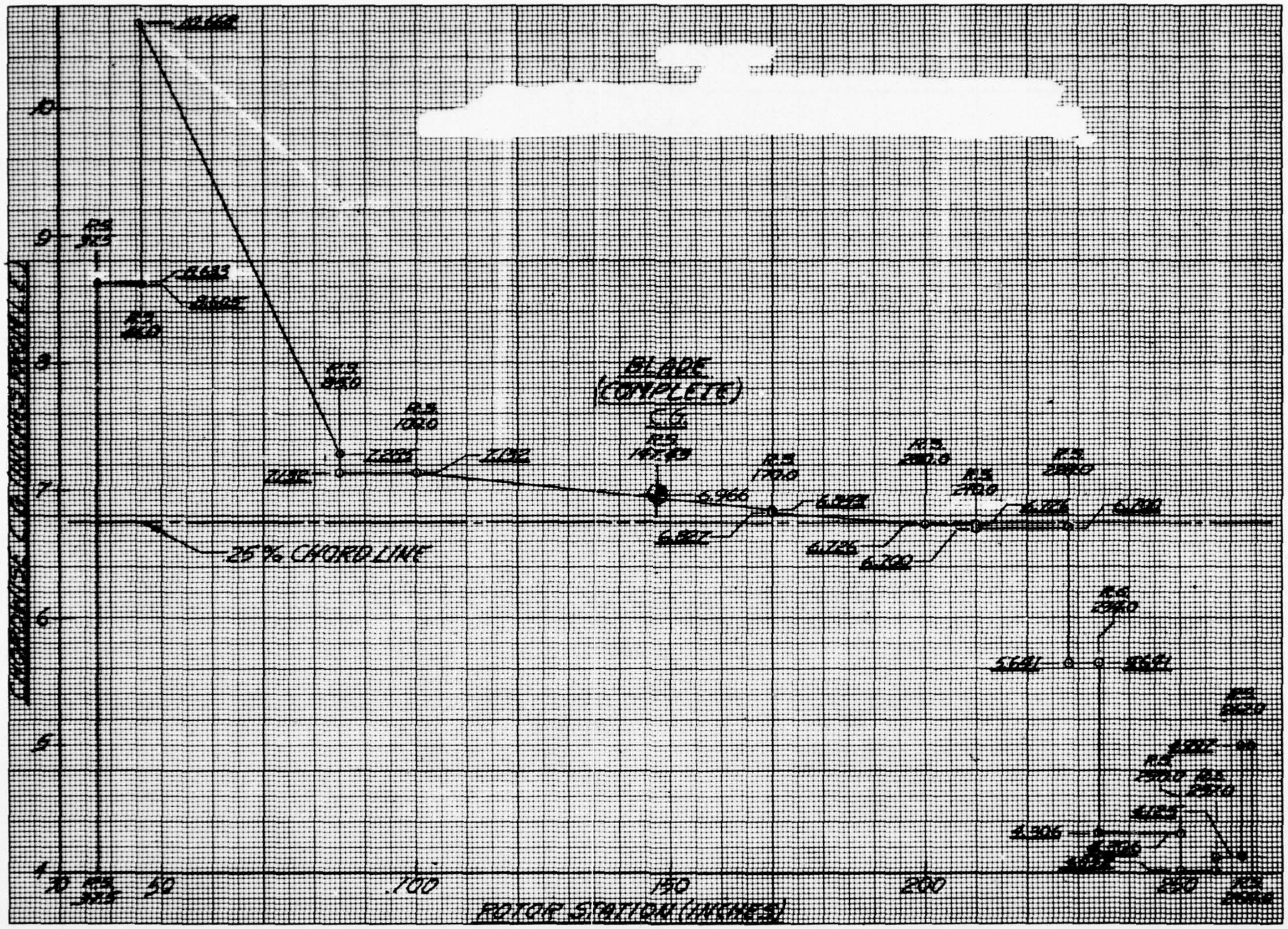


Figure A-2. MTS main rotor blade assembly, chordwise center of gravity distribution.

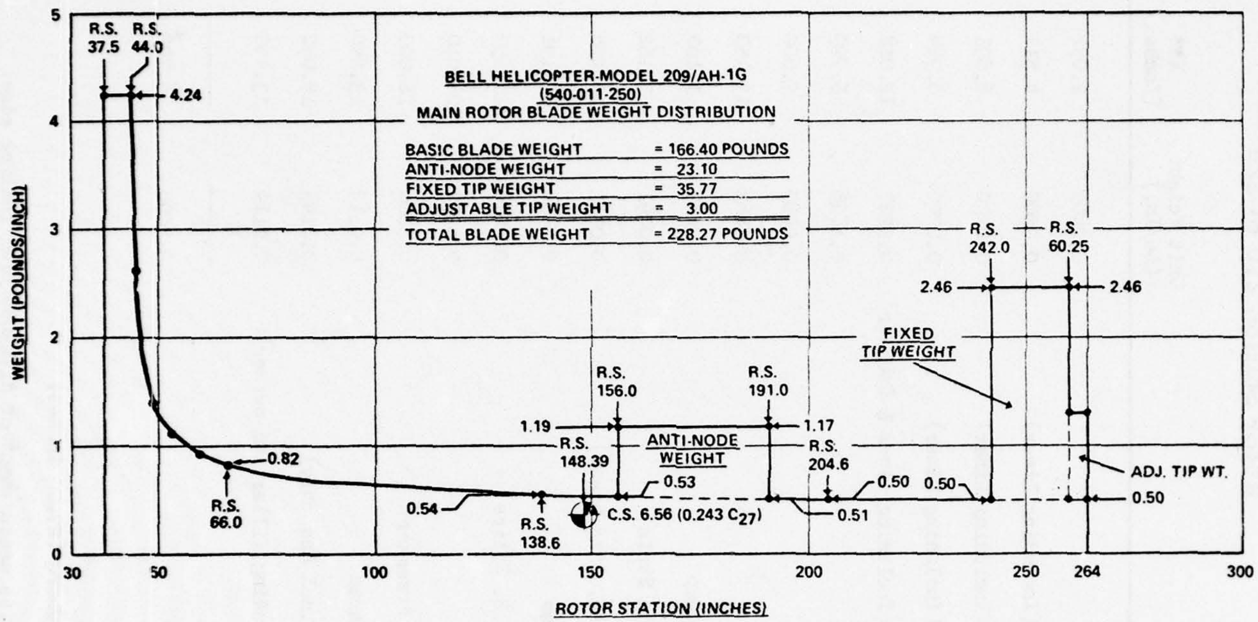


Figure A-3. Radial blade weight distribution – Bell (PN 540-011-250).

TABLE A-1. MTS MAIN ROTOR BLADE ASSEMBLY, TYPICAL BLADE CROSS SECTION DETAIL WEIGHT AND BALANCE

Rotor Station 210 to 228

	Unit Weight (Lb/In.)	X** (Inches)	WX (Lb-In/In.)
L.E. Member	0.2469	2.052	0.5066
Tube No. 1 (Including Liner)	0.0200	4.511	0.0902
Tube No. 2 (Including Liner)	0.0200	6.891	0.1378
Tube No. 3 (Including Liner)	0.0200	8.984	0.1797
Tube No. 4 (Including Liner & Doubler)	0.0227	12.018	0.2728
Spar Caps	0.1826	6.729	1.2288
Spar Longos	0.0489	7.000	0.3423
Skin	0.0463	13.450	0.6227
L.E. Splice Cap	0.0145	1.160	0.0168
L.E. Abrasion Strip	0.0091	1.162	0.0106
Aft Tube (Including Liner)	0.0141	17.028	0.2401
Aft Honeycomb	0.0144	19.191	0.2706
Honeycomb T.E. Splice	0.0018	22.250	0.0401
T.E. Longos	0.0097	26.010	0.2523
Lightening Arrester	0.0006	26.000	0.0156
Vacuum Diaphram	0.0112	13.240	0.1483
Adhesive (Final Assembly)	0.0143	15.042	0.2151
Paint (Including filler and primer)	0.0119	13.450	0.1601
TOTAL	0.7090	6.700*	4.7505

* 24.8% of Chord (27.00 inches)

**X - Chordwise measurement of distance from leading edge.

TABLE A-2.

MTS MAIN ROTOR BLADE ASSEMBLY, BLADE SPANWISE DISTRIBUTION

SHEET 1

#/IN	R	WR	WRR	C	WC	WCC	WCR
1.54275	37.75	58.24	2198.5	8.631	13.32	114.9	502.7
1.54275	38.25	59.01	2257.1	8.630	13.31	114.9	509.2
1.54275	38.75	59.78	2316.5	8.628	13.31	114.8	515.8
1.54275	39.25	60.55	2376.7	8.626	13.31	114.8	522.4
1.54275	39.75	61.32	2437.6	8.625	13.31	114.8	528.9
1.54275	40.25	62.10	2499.4	8.623	13.30	114.7	535.5
1.54275	40.75	62.87	2561.8	8.621	13.30	114.7	542.0
1.54275	41.25	63.64	2625.1	8.620	13.30	114.6	548.6
1.54275	41.75	64.41	2689.1	8.618	13.30	114.6	555.1
1.54275	42.25	65.18	2753.9	8.617	13.29	114.5	561.6
1.54275	42.75	65.95	2819.5	8.615	13.29	114.5	568.2
1.54275	43.25	66.72	2885.8	8.613	13.29	114.5	574.7
1.54275	43.75	67.50	2952.9	8.612	13.29	114.4	581.2
1.54275	44.25	68.27	3020.8	8.610	13.28	114.4	587.8
1.54275	44.75	69.04	3089.5	8.608	13.28	114.3	594.3
1.54275	45.25	69.81	3158.9	8.607	13.28	114.3	600.8
1.54275	45.75	70.58	3229.1	8.605	13.28	114.2	607.3
WEIGHT (Lbs.)							
26.23	41.75	1095	45872	8.618	226.03	1948	9436

TABLE A-2. (Continued)

MTS MAIN ROTOR BLADE ASSEMBLY,
BLADE SPANWISE DISTRIBUTION

SHEET 2

#/IN	R	WR	WRR	C	WC	WCC	WCR
1.58337	46.50	73.63	3423.6	10.581	16.75	177.3	779.1
1.56271	47.50	74.23	3525.9	10.495	16.40	172.1	779.0
1.54205	48.50	74.79	3627.3	10.408	16.05	167.0	778.4
1.52138	49.50	75.31	3727.8	10.321	15.70	162.1	777.3
1.50072	50.50	75.79	3827.2	10.234	15.36	157.2	775.6
1.48006	51.50	76.22	3925.5	10.148	15.02	152.4	773.5
1.45940	52.50	76.62	4022.5	10.061	14.68	147.7	770.8
1.43874	53.50	76.97	4118.0	9.974	14.35	143.1	767.7
1.41808	54.50	77.29	4212.0	9.887	14.02	138.6	764.1
1.39742	55.50	77.56	4304.4	9.801	13.70	134.2	760.1
1.37675	56.50	77.79	4394.9	9.714	13.37	129.9	755.6
1.35609	57.50	77.98	4483.6	9.627	13.06	125.7	750.7
1.33543	58.50	78.12	4570.2	9.540	12.74	121.5	745.3
1.31477	59.50	78.23	4654.6	9.454	12.43	117.5	739.5
1.29411	60.50	78.29	4736.8	9.367	12.12	113.5	733.4
1.27345	61.50	78.32	4816.5	9.280	11.82	109.7	726.[illegible]
1.25278	62.50	78.30	4893.7	9.193	11.52	105.9	719.8
1.23212	63.50	78.24	4968.2	9.107	11.22	102.2	712.5
1.21146	64.50	78.14	5040.0	9.020	10.93	98.6	704.8
1.19080	65.50	78.00	5108.8	8.933	10.64	95.0	696.8
1.17014	66.50	77.81	5174.6	8.846	10.35	91.6	688.4
1.14948	67.50	77.59	5237.3	8.760	10.07	88.2	679.7
1.12882	68.50	77.32	5296.7	8.673	9.79	84.9	670.6
1.10815	69.50	77.02	5352.7	8.586	9.51	81.7	661.3
1.08749	70.50	76.67	5405.1	8.499	9.24	78.6	651.6
1.06683	71.50	76.28	5453.9	8.413	8.97	75.5	641.7
1.04617	72.50	75.85	5498.9	8.326	8.71	72.5	631.5
1.02551	73.50	75.37	5540.0	8.239	8.45	69.6	621.0
1.00485	74.50	74.86	5577.1	8.152	8.19	66.8	610.3
.98418	75.50	74.31	5610.1	8.066	7.94	64.0	599.3
.96352	76.50	73.71	5638.8	7.979	7.69	61.3	588.1
.94286	77.50	73.07	5663.1	7.892	7.44	58.7	576.7
.92220	78.50	72.39	5682.8	7.805	7.20	56.2	565.1
.90154	79.50	71.67	5697.9	7.719	6.96	53.7	553.2
.88088	80.50	70.91	5708.3	7.632	6.72	51.3	541.2
.86022	81.50	70.11	5713.8	7.545	6.49	49.0	529.0
.83955	82.50	69.26	5714.2	7.458	6.26	46.7	516.6
.81889	83.50	68.38	5709.5	7.372	6.04	44.5	504.1
.79823	84.50	67.45	5699.6	7.285	5.82	42.4	491.4
WEIGHT (Lbs.)							
46.44	63.30	2940	191756	9.124	423.72	3908	26332

TABLE A-2. (Continued)

MTS MAIN ROTOR BLADE ASSEMBLY, BLADE SPANWISE DISTRIBUTION

SHEET 3

#/IN	R	WR	WRR	C	WC	WCC	WCR
.72980	85.50	62.40	5335.0	7.132	5.20	37.1	445.0
.72980	86.50	63.13	5460.5	7.132	5.20	37.1	450.2
.72980	87.50	63.86	5587.5	7.132	5.20	37.1	455.4
.72980	88.50	64.59	5716.0	7.132	5.20	37.1	460.6
.72980	89.50	65.32	5845.9	7.132	5.20	37.1	465.8
.72980	90.50	66.05	5977.2	7.132	5.20	37.1	471.0
.72980	91.50	66.78	6110.1	7.132	5.20	37.1	476.3
.72980	92.50	67.51	6244.4	7.132	5.20	37.1	481.5
.72980	93.50	68.24	6380.1	7.132	5.20	37.1	486.7
.72980	94.50	68.97	6517.3	7.132	5.20	37.1	491.9
.72980	95.50	69.70	6656.0	7.132	5.20	37.1	497.1
.72980	96.50	70.43	6796.1	7.132	5.20	37.1	502.3
.72980	97.50	71.16	6937.7	7.132	5.20	37.1	507.5
.72980	98.50	71.89	7080.7	7.132	5.20	37.1	512.7
.72980	99.50	72.62	7225.2	7.132	5.20	37.1	517.9
WEIGHT (Lbs.)							
10.95	92.50	1013	93870	7.132	78.07	557	7222

TABLE A-2. (Continued)

MTS MAIN ROTOR BLADE ASSEMBLY,
BLADE SPANWISE DISTRIBUTION

SHEET 4

#/IN	R	WR	WRR	C	WC	WCC	WCR
.72972	100.50	73.34	7370.3	7.128	5.20	37.1	522.7
.72955	101.50	74.05	7516.0	7.124	5.20	37.0	527.5
.72939	102.50	74.76	7663.1	7.120	5.19	37.0	532.3
.72922	103.50	75.47	7811.6	7.116	5.19	36.9	537.1
.72905	104.50	76.19	7961.5	7.112	5.19	36.9	541.8
.72889	105.50	76.90	8112.7	7.108	5.18	36.8	546.6
.72872	106.50	77.61	8265.4	7.104	5.18	36.8	551.3
.72856	107.50	78.32	8419.4	7.100	5.17	36.7	556.1
.72839	108.50	79.03	8574.8	7.096	5.17	36.7	560.8
.72823	109.50	79.74	8731.6	7.092	5.16	36.6	565.5
.72806	110.50	80.45	8889.8	7.088	5.16	36.6	570.2
.72789	111.50	81.16	9049.4	7.084	5.16	36.5	575.0
.72773	112.50	81.87	9210.3	7.080	5.15	36.5	579.7
.72756	113.50	82.58	9372.6	7.076	5.15	36.4	584.3
.72740	114.50	83.29	9536.4	7.072	5.14	36.4	589.0
.72723	115.50	84.00	9701.4	7.068	5.14	36.3	593.7
.72707	116.50	84.70	9867.9	7.064	5.14	36.3	598.4
.72690	117.50	85.41	10035.8	7.060	5.13	36.2	603.0
.72673	118.50	86.12	10205.0	7.056	5.13	36.2	607.7
.72657	119.50	86.82	10375.6	7.052	5.12	36.1	612.3
.72640	120.50	87.53	10547.6	7.048	5.12	36.1	616.9
.72624	121.50	88.24	10720.9	7.044	5.12	36.0	621.6
.72607	122.50	88.94	10895.6	7.040	5.11	36.0	626.2
.72591	123.50	89.65	11071.7	7.036	5.11	35.9	630.8
.72574	124.50	90.35	11249.2	7.032	5.10	35.9	635.4
.72557	125.50	91.06	11428.0	7.028	5.10	35.8	640.0
.72541	126.50	91.76	11608.2	7.024	5.10	35.8	644.6
.72524	127.50	92.47	11789.7	7.020	5.09	35.7	649.2
.72508	128.50	93.17	11972.7	7.016	5.09	35.7	653.7
.72491	129.50	93.88	12156.9	7.012	5.08	35.6	658.3
.72475	130.50	94.58	12342.6	7.008	5.08	35.6	662.9
.72458	131.50	95.28	12529.6	7.004	5.08	35.5	667.4
.72441	132.50	95.98	12718.0	7.000	5.07	35.5	671.9
.72425	133.50	96.69	12907.7	6.996	5.07	35.5	676.5
.72408	134.50	97.39	13098.8	6.993	5.06	35.4	681.0
.72392	135.50	98.09	13291.3	6.989	5.06	35.4	685.5
.72375	136.50	98.79	13485.1	6.985	5.06	35.3	690.0
.72359	137.50	99.49	13680.3	6.981	5.05	35.3	694.5
.72342	138.50	100.19	13876.8	6.977	5.05	35.2	699.0
.72325	139.50	100.89	14074.7	6.973	5.04	35.2	703.5

TABLE A-2. (Continued)

MTS MAIN ROTOR BLADE ASSEMBLY, BLADE SPANWISE DISTRIBUTION

SHEET 5

#/IN	R	WR	WRR	C	WC	WCC	WCR
.72309	140.50	101.59	14273.9	6.969	5.04	35.1	708.0
.72292	141.50	102.29	14474.5	6.965	5.03	35.1	712.4
.72276	142.50	102.99	14676.5	6.961	5.03	35.0	716.9
.72259	143.50	103.69	14879.8	6.957	5.03	35.0	721.3
.72243	144.50	104.39	15084.4	6.953	5.02	34.9	725.8
.72226	145.50	105.09	15290.4	6.949	5.02	34.9	730.2
.72209	146.50	105.79	15497.8	6.945	5.01	34.8	734.7
.72193	147.50	106.48	15706.5	6.941	5.01	34.8	739.1
.72176	148.50	107.18	15916.5	6.937	5.01	34.7	743.5
.72160	149.50	107.88	16127.9	6.933	5.00	34.7	747.9
.72143	150.50	108.58	16340.6	6.929	5.00	34.6	752.3
.72127	151.50	109.27	16554.7	6.925	4.99	34.6	756.7
.72110	152.50	109.97	16770.1	6.921	4.99	34.5	761.1
.72093	153.60	110.66	16986.8	6.917	4.99	34.5	765.4
.72077	154.50	111.36	17204.9	6.913	4.98	34.4	769.8
.72060	155.50	112.05	17424.4	6.909	4.98	34.4	774.2
.72044	156.50	112.75	17645.1	6.905	4.97	34.3	778.5
.72027	157.50	113.44	17867.2	6.901	4.97	34.3	782.8
.72011	158.50	114.14	18090.7	6.897	4.97	34.3	787.2
.71994	159.50	114.83	18315.5	6.893	4.96	34.2	791.5
.71977	160.50	115.52	18541.6	6.889	4.96	34.2	795.8
.71961	161.50	116.22	18769.0	6.885	4.95	34.1	800.1
.71944	162.50	116.91	18997.8	6.881	4.95	34.1	804.4
.71928	163.50	117.60	19227.9	6.877	4.95	34.0	808.7
.71911	164.50	118.29	19459.3	6.873	4.94	34.0	813.0
.71895	165.50	118.99	19692.1	6.869	4.94	33.9	817.3
.71878	166.50	119.68	19926.2	6.865	4.93	33.9	821.6
.71861	167.50	120.37	20161.6	6.861	4.93	33.8	825.8
.71845	168.50	121.06	20398.4	6.857	4.93	33.8	830.1
.71828	169.50	121.75	20636.4	6.853	4.92	33.7	834.3
WEIGHT (Lbs.) 50.68	134.91	6837	943054	6.991	354.30	2477	47715

TABLE A-2. (Continued)

MTS MAIN ROTOR BLADE ASSEMBLY, BLADE SPANWISE DISTRIBUTION

SHEET 6

#/IN	R	WR	WRR	C	WC	WCC	WCR
.71564	170.50	122.02	20803.7	6.824	4.88	33.3	832.6
.71551	171.50	122.71	21044.6	6.820	4.88	33.3	836.9
.71538	172.50	123.40	21286.9	6.817	4.88	33.2	841.2
.71525	173.50	124.10	21530.5	6.814	4.87	33.2	845.5
.71512	174.50	124.79	21775.4	6.810	4.87	33.2	849.8
.71499	175.50	125.48	22021.7	6.807	4.87	33.1	854.1
.71486	176.50	126.17	22269.3	6.803	4.86	33.1	858.4
.71473	177.50	126.86	22518.3	6.800	4.86	33.0	862.7
.71460	178.50	127.56	22768.6	6.797	4.86	33.0	867.0
.71447	179.50	128.25	23020.2	6.793	4.85	33.0	871.2
.71434	180.50	128.94	23273.2	6.790	4.85	32.9	875.5
.71421	181.50	129.63	23527.5	6.787	4.85	32.9	879.7
.71408	182.50	130.32	23783.2	6.783	4.84	32.9	884.0
.71395	183.50	131.01	24040.1	6.780	4.84	32.8	888.2
.71382	184.50	131.70	24298.4	6.777	4.84	32.8	892.5
.71369	185.50	132.39	24558.1	6.773	4.83	32.7	896.7
.71356	186.50	133.08	24819.0	6.770	4.83	32.7	900.9
.71343	187.50	133.77	25081.3	6.766	4.83	32.7	905.1
.71330	188.50	134.46	25345.0	6.763	4.82	32.6	909.3
.71317	189.50	135.14	25609.9	6.760	4.82	32.6	913.5
.71304	190.50	135.83	25876.2	6.756	4.82	32.5	917.7
.71291	191.50	136.52	26143.8	6.753	4.81	32.5	921.9
.71278	192.50	137.21	26412.8	6.750	4.81	32.5	926.1
.71265	193.50	137.90	26683.0	6.746	4.81	32.4	930.3
.71252	194.50	138.58	26954.6	6.743	4.80	32.4	934.4
.71239	195.50	139.27	27227.5	6.739	4.80	32.4	938.6
.71226	196.50	139.96	27501.8	6.736	4.80	32.3	942.8
.71213	197.50	140.64	27777.3	6.733	4.79	32.3	946.9
.71200	198.50	141.33	28054.2	6.729	4.79	32.2	951.1
.71187	199.50	142.02	28332.4	6.726	4.79	32.2	955.2
WEIGHT (Lbs.)							
21.41	184.99	3961	734339	6.775	145.07	983	26830

TABLE A-2. (Continued)

MTS MAIN ROTOR BLADE ASSEMBLY, BLADE SPANWISE DISTRIBUTION

SHEET 7

#/IN	R	WR	WRR	C	WC	WCC	WCR
.71180	200.50	142.72	28614.5	6.726	4.79	32.2	959.9
.71180	201.50	143.43	28900.7	6.726	4.79	32.2	964.7
.71180	202.50	144.14	29188.2	6.726	4.79	32.2	969.5
.71180	203.50	144.85	29477.2	6.726	4.79	32.2	974.3
.71180	204.50	145.56	29767.7	6.726	4.79	32.2	979.1
.71180	205.50	146.27	30059.5	6.726	4.79	32.2	983.8
.71180	206.50	146.99	30352.8	6.726	4.79	32.2	988.6
.71180	207.50	147.70	30647.4	6.726	4.79	32.2	993.4
.71180	208.50	148.41	30943.5	6.726	4.79	32.2	998.2
.71180	209.50	149.12	31241.1	6.726	4.79	32.2	1003.0
WEIGHT (Lbs.)							
7.12	205.00	1459	299193	6.726	47.88	322	9815

#/IN	R	WR	WRR	C	WC	WCC	WCR
.70900	210.50	149.24	31416.0	6.700	4.75	31.8	999.9
.70900	211.50	149.95	31715.2	6.700	4.75	31.8	1004.7
.70900	212.50	150.66	32015.8	6.700	4.75	31.8	1009.4
.70900	213.50	151.37	32317.8	6.700	4.75	31.8	1014.2
.70900	214.50	152.08	32621.3	6.700	4.75	31.8	1018.9
.70900	215.50	152.79	32926.1	6.700	4.75	31.8	1023.7
.70900	216.50	153.50	33232.4	6.700	4.75	31.8	1028.4
.70900	217.50	154.21	33540.1	6.700	4.75	31.8	1033.2
.70900	218.50	154.92	33849.3	6.700	4.75	31.8	1037.9
.70900	219.50	155.63	34159.8	6.700	4.75	31.8	1042.7
.70900	220.50	156.33	34471.8	6.700	4.75	31.8	1047.4
.70900	221.50	157.04	34785.1	6.700	4.75	31.8	1052.2
.70900	222.50	157.75	35099.9	6.700	4.75	31.8	1056.9
.70900	223.50	158.46	35416.1	6.700	4.75	31.8	1061.7
.70900	224.50	159.17	35733.8	6.700	4.75	31.8	1066.4
.70900	225.50	159.88	36052.8	6.700	4.75	31.8	1071.2
.70900	226.50	160.59	36373.3	6.700	4.75	31.8	1075.9
.70900	227.50	161.30	36695.2	6.700	4.75	31.8	1080.7
WEIGHT (Lbs.)							
12.76	219.00	2795	612422	6.700	85.51	573	18726

TABLE A-2. (Continued)

MTS MAIN ROTOR BLADE ASSEMBLY, BLADE SPANWISE DISTRIBUTION

SHEET 8

#/IN	R	WR	WRR	C	WC	WCC	WCR
1.10400	228.50	252.26	57642.3	5.641	6.23	35.1	1423.0
1.10400	229.50	253.37	58148.0	5.641	6.23	35.1	1429.2
1.10400	230.50	254.47	58655.8	5.641	6.23	35.1	1435.5
1.10400	231.50	255.58	59165.8	5.641	6.23	35.1	1441.7
1.10400	232.50	256.68	59678.1	5.641	6.23	35.1	1447.9
1.10400	233.50	257.78	60192.6	5.641	6.23	35.1	1454.2
WEIGHT (Lbs.)							
6.62	231.00	1530	353483	5.641	37.37	211	8632

#/IN	R	WR	WRR	C	WC	WCC	WCR
1.46460	234.50	343.45	80538.7	4.306	6.31	27.2	1478.9
1.46460	235.50	344.91	81227.1	4.306	6.31	27.2	1485.2
1.46460	236.50	346.38	81918.4	4.306	6.31	27.2	1491.5
1.46460	237.50	347.84	82612.6	4.306	6.31	27.2	1497.8
1.46460	238.50	349.31	83309.7	4.306	6.31	27.2	1504.1
1.46460	239.50	350.77	84009.8	4.306	6.31	27.2	1510.4
1.46460	240.50	352.24	84712.8	4.306	6.31	27.2	1516.7
1.46460	241.50	353.70	85418.8	4.306	6.31	27.2	1523.0
1.46460	242.50	355.17	86127.6	4.306	6.31	27.2	1529.3
1.46460	243.50	356.63	86839.4	4.306	6.31	27.2	1535.6
1.46460	244.50	358.09	87554.2	4.306	6.31	27.2	1542.0
1.46460	245.50	359.56	88271.8	4.306	6.31	27.2	1548.3
1.46460	246.50	361.02	88992.4	4.306	6.31	27.2	1554.6
1.46460	247.50	362.49	89715.9	4.306	6.31	27.2	1560.9
1.46460	248.50	363.95	90442.3	4.306	6.31	27.2	1567.2
1.46460	249.50	365.42	91171.7	4.306	6.31	27.2	1573.5
WEIGHT (Lbs.)							
23.43	242.00	5671	1372363	4.306	100.91	434	24419

TABLE A-2. (Concluded)

MTS MAIN ROTOR BLADE ASSEMBLY, BLADE SPANWISE DISTRIBUTION

SHEET 9

#/IN	R	WR	WRR	C	WC	WCC	WCR
1.53700	250.50	385.02	96447.1	4.052	6.23	25.2	1560.1
1.53700	251.50	386.56	97213.7	4.052	6.23	25.2	1566.3
1.53700	252.50	388.09	97993.4	4.052	6.23	25.2	1572.6
1.53700	253.50	389.63	98771.1	4.052	6.23	25.2	1578.3
1.53700	254.50	391.17	99551.9	4.052	6.23	25.2	1585.0
1.53700	255.50	392.70	100335.7	4.052	6.23	25.2	1591.2
1.53700	256.50	394.24	101122.7	4.052	6.23	25.2	1597.5
WEIGHT (Lbs.)							
10.76	253.50	2727	691441	4.052	43.60	177	11051

#/IN	R	WR	WRR	C	WC	WCC	WCR
2.05980	257.50	530.40	136577.6	4.125	8.50	35.0	2187.9
2.05980	258.50	532.46	137640.5	4.125	8.50	35.0	2196.4
2.05980	259.50	534.52	138707.4	4.125	8.50	35.0	2204.9
2.05980	260.50	536.58	139778.5	4.125	8.50	35.0	2213.4
2.05980	261.50	538.64	140853.8	4.125	8.50	35.0	2221.9
WEIGHT (Lbs.)							
10.30	259.50	2673	693558	4.125	42.48	175	11024

#/IN	R	WR	WRR	C	WC	WCC	WCR
3.12480	262.50	820.26	215318.3	4.997	15.61	78.0	4098.8
3.12480	263.50	823.38	216961.9	4.997	15.61	78.0	4114.5
WEIGHT (Lbs.)							
6.25	263.00	1644	432280	4.997	31.23	156	8213

WEIGHT (Lbs.)							
232.95	147.43	34344	6464130	6.938	1616.14	11921	209414

APPENDIX B

STRUCTURAL DATA FOR MTS ROTOR BLADE FOR AH-1G HELICOPTER

REPORT TITLE	MTS Main Rotor Blade Assy, Structural Analysis Report	REPORT NO.	150-S-1001
PREPARED BY	D. H. Mancill 12/76	SUBJECT	MODEL NO.
CHECKED BY		MTS Blade	

TABLE B-1. SUMMARY – STATIC MINIMUM MARGINS OF SAFETY

ITEM	LOAD CONDITION	MARGIN OF SAFETY
Blade Root End		
Main Pin Joint	Bearing on chopped E-glass/epoxy	.77
Aft Drag Brace Attach Point	Bearing on chopped E-glass/epoxy	.99
"FEP"		
Film Vacuum Bondable Material	Bond shear	.96
Basic Blade Section		
Leading Edge Longos	Tension	3.38
Spar Tube	Tension	1.80
Outer Skin Spar Cap	Shear	1.10
Spar	Shear	.95
Outer Skin	Tension	2.35
C-Channel	Shear	2.30
Aft Tube	Tension	3.00
Trailing Edge Longos	Buckling	.58
Blade Tip		
Nose Tip Weight Attach	Tension in L.E. longos	.92
Middle Tip Weight Attach	Tension in spar tube	.79

REPORT TITLE MTS Main Rotor Blade Assy, Structural Analysis Report		REPORT NO. 150-S-1001	
PREPARED BY D. H. Mancill 12/76	SUBJECT	MODEL NO.	
CHECKED BY	MTS Blade		

INTRODUCTION

This report contains the structural data for the MTS rotor blade for the AH-1G helicopter.

Section 1 presents computed and measured MTS blade physical properties.

Section 2 contains the static blade loads and stress analysis.

Section 3 presents the blade L-N fatigue curves.

Section 4 contains a comparative tip deflection study of the MTS blade and model 540 metal blade.

The Appendix contains computer output from the "BOX" program

COMPUTED AND MEASURED BLADE PHYSICAL PROPERTIES

The blade bending and axial stiffness properties were calculated by Hughes' section properties computer program utilizing laminate elastic properties generated by the "PROP" computer program. Blade torsional stiffness was calculated by Hughes' "BOX" computer program. Again "PROP" program supplied the laminate elastic properties (shear modulus). These calculated stiffnesses are compared to measured results obtained in full-scale blade stiffness tests.

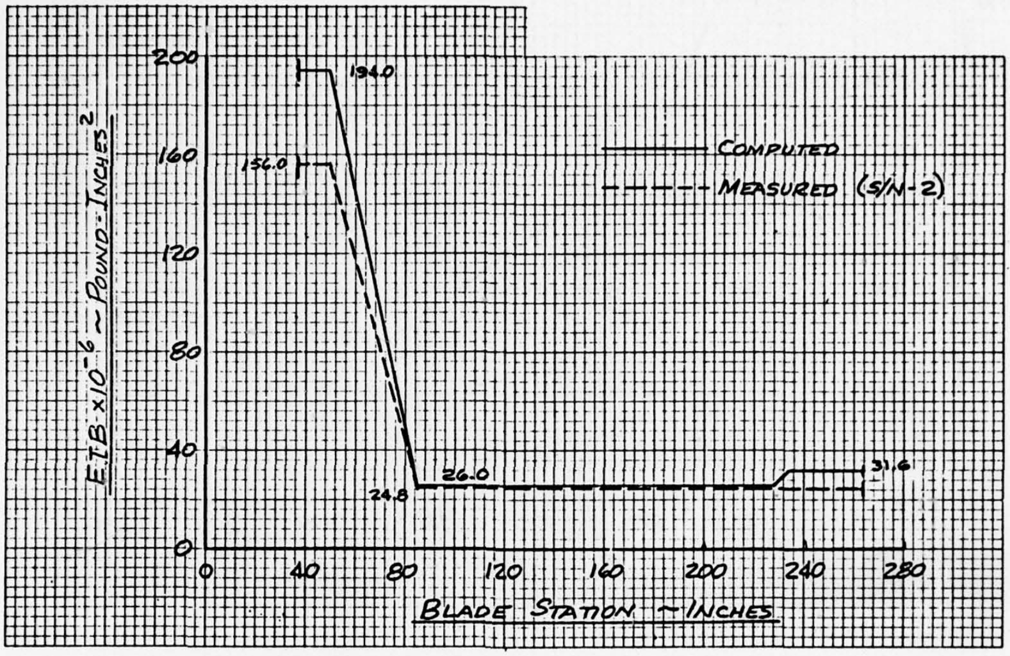


Figure B-1. MTS blade beamwise stiffness.

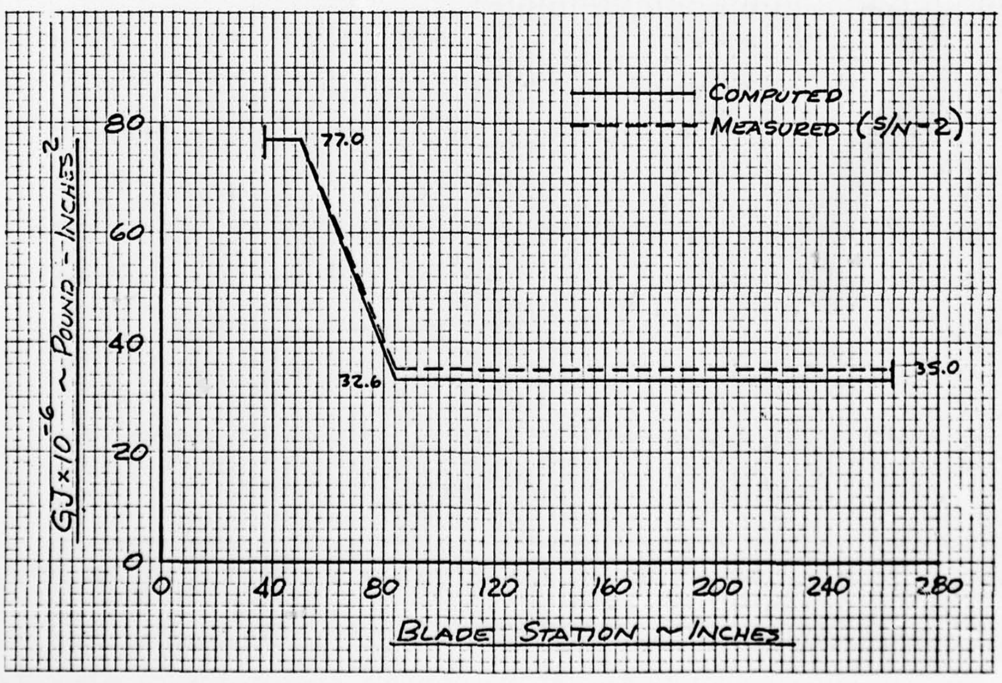


Figure B-2. MTS blade torsional stiffness.

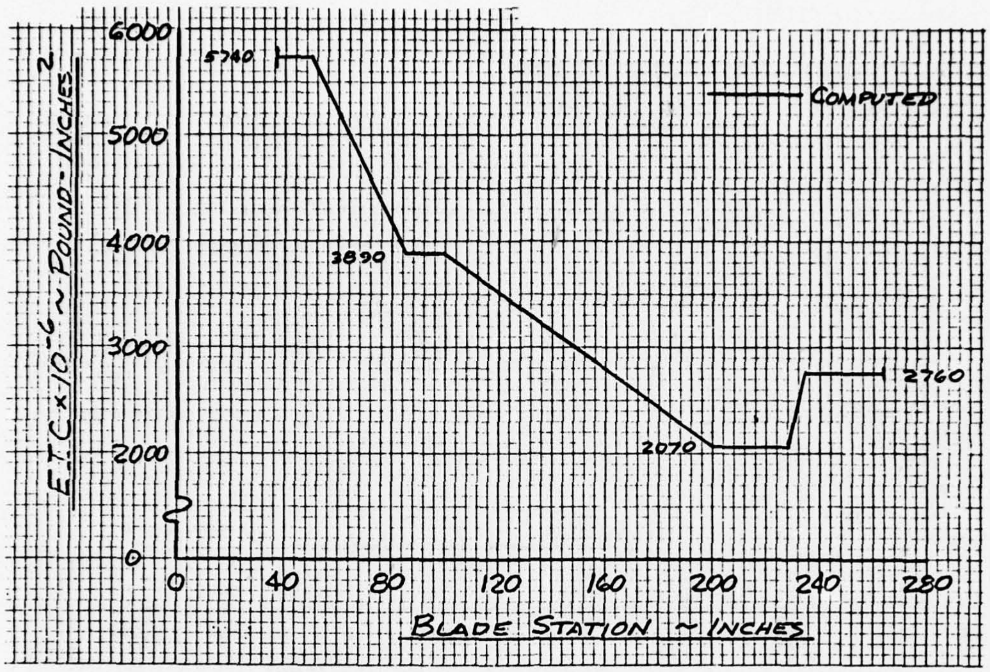


Figure B-3. MTS blade chordwise stiffness.

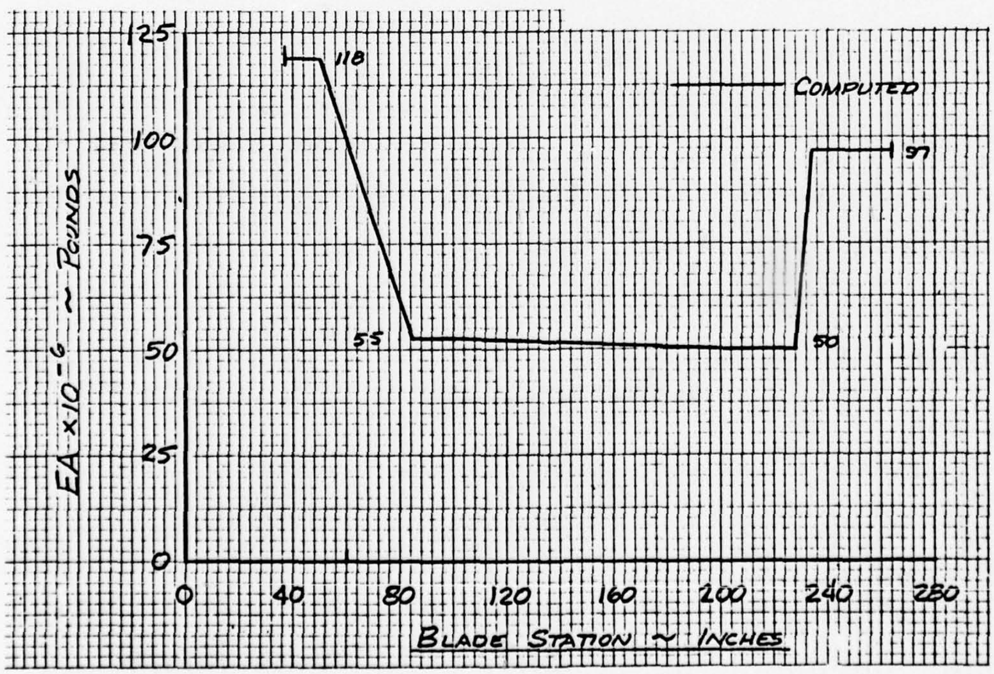


Figure B-4. MTS blade axial stiffness.

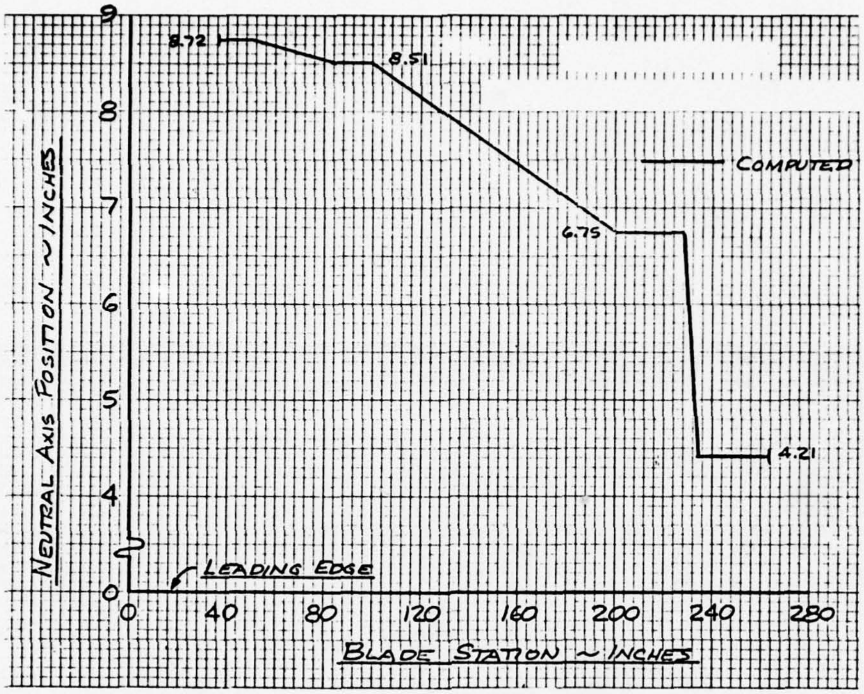


Figure B-5. MTS blade neutral axis position.

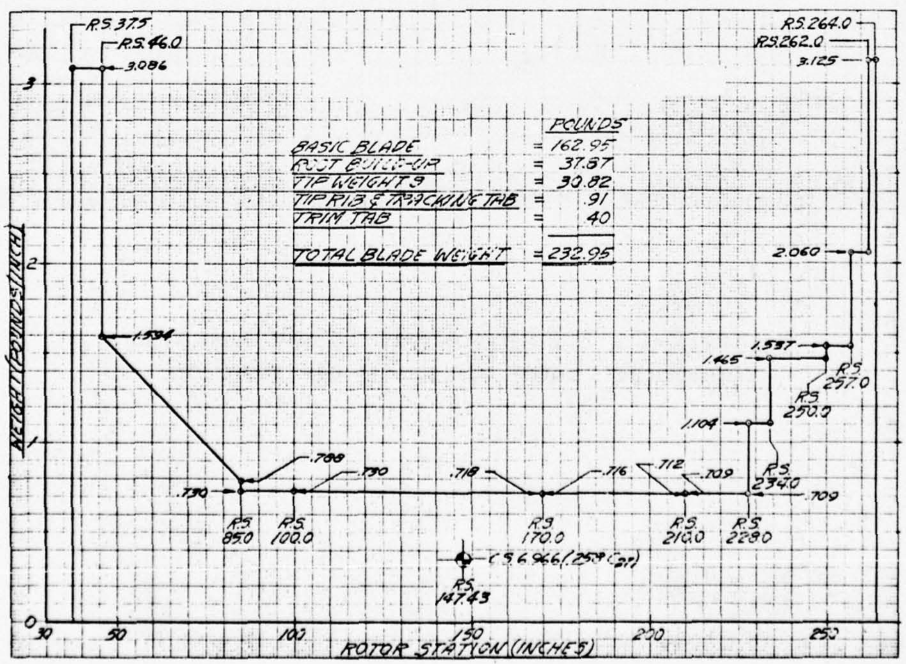


Figure B-6. MTS main rotor blade assembly, radial weight distribution.

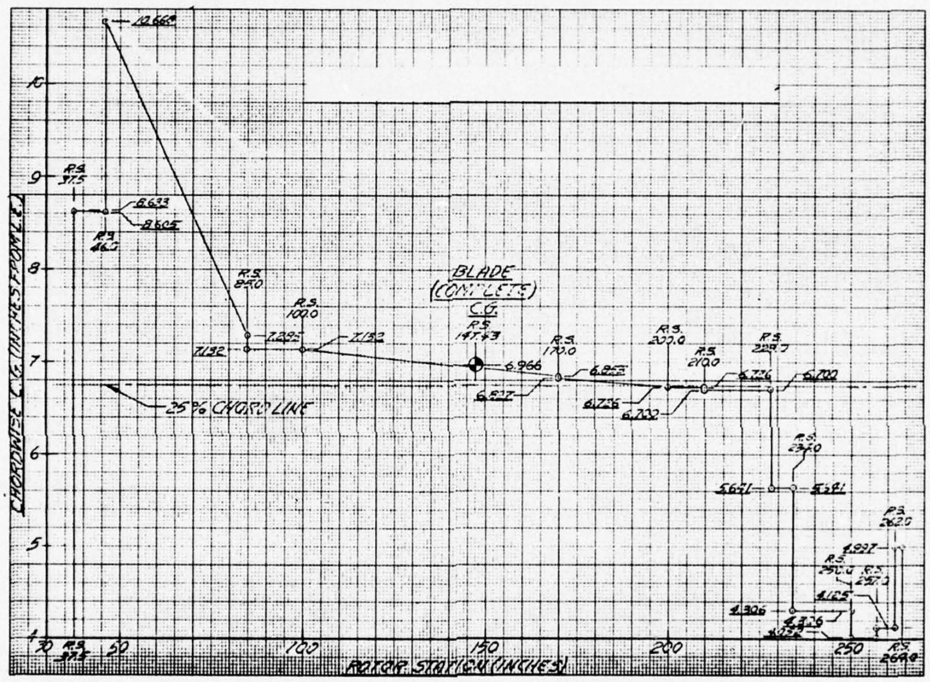


Figure B-7. MTS main rotor blade assembly, chordwise center of gravity distribution.

STATIC BLADE LOADS AND STRESS ANALYSIS

This section contains the static load determination and structural analysis of the MTS blade for the AH-1G helicopter. The load requirements for the MTS blade are in all cases equal to the model 540 metal blade. The loading conditions 1 thru 4 (see page 156) are identical to the conditions in Bell's stress report (Ref. 3 page 2.02). In addition, the MTS blade is checked for ground flapping and rotor starting. All loads are limit loads unless otherwise noted. The ultimate factor is 1.5. The margin of safety is based on either yield or ultimate allowables depending on which is more critical.

The strength of the laminates was computed by the "PROP" computer program (computer output shown in Appendix). Experimental evaluation of the computed laminate strength was accomplished by tubular coupon tests. In addition, "Fan Belt" type of coupons were tested to evaluate the strength of unidirectional fibers/epoxy that wrap around bushings. This type of construction is used at the tip and root end of the blade.

The strength of the root end and blade tip is further substantiated (experimentally) by the root-end ultimate pull test and tip-end start/stop test.

REPORT TITLE		REPORT NO. 150-S-1001	
PREPARED BY D. MANCILL	DEC 3, 76	SUBJECT	MODEL NO.
CHECKED BY		MTS BLADE	

DESIGN STATIC LOADING CONDITIONS FOR THE MTS BLADE

THE CRITICAL STATIC LOADING CONDITIONS ARE SHOWN BELOW. CONDITIONS 1 THROUGH 4 ARE IDENTICAL TO THE MODEL 540 METAL BLADE CONDITIONS SHOWN IN THE BELL STRESS REPORT (REF 3, PAGE 2.02). GROUND FLAPPING AND MAIN ROTOR STARTING ARE ADDITIONAL CONDITIONS.

CONDITION	M_{co} IN-LB	RPM	HELICOPTER VERTICAL G'S	BLADE VERTICAL G'S
1	+450 000	280	+3.5	—
2	-250 000	280	+3.5	—
3	+450000	356	-0.5	—
4	-250 000	356	-0.5	—
GROUND FLAPPING	—	0	1.0	2.67
MAIN ROTOR STARTING	72000	0	1.0	1.0

M_{co} IS THE CHORD BENDING MOMENT PER BLADE AT THE ℄ OF THE ROTOR.

GROSS WEIGHT = 6600 LB

SIGN CONVENTION

FLAPWISE BENDING MOMENT – POSITIVE DENOTES TENSION IN THE LOWER SIDE OF BLADE.

CHORDWISE BENDING MOMENT – POSITIVE DENOTES TENSION IN LEADING EDGE OF BLADE

TORSION MOMENT – POSITIVE DENOTES NOSE UP.

AXIAL LOADS – POSITIVE DENOTES TENSION.

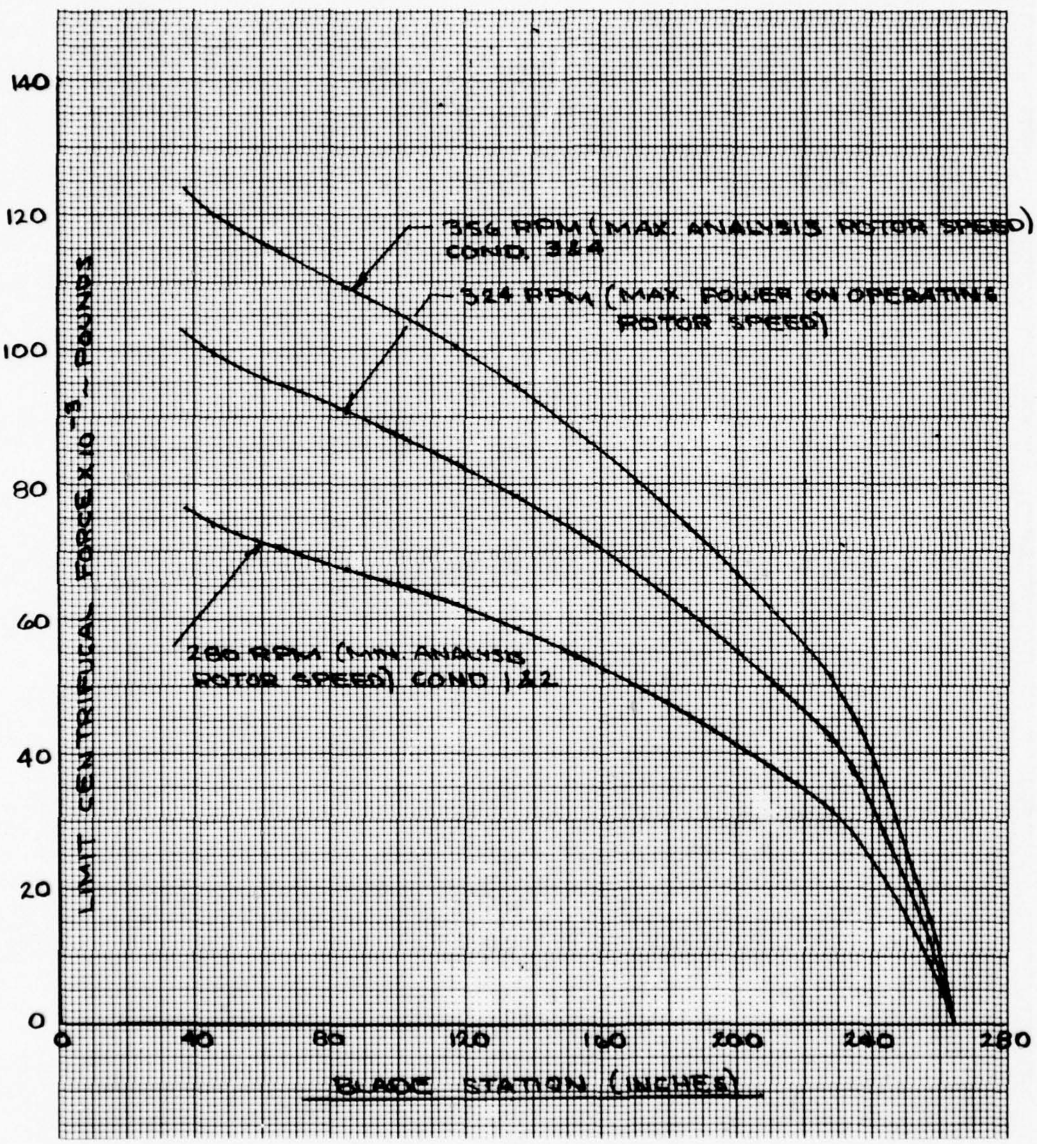


Figure B-8. Centrifugal force curves.

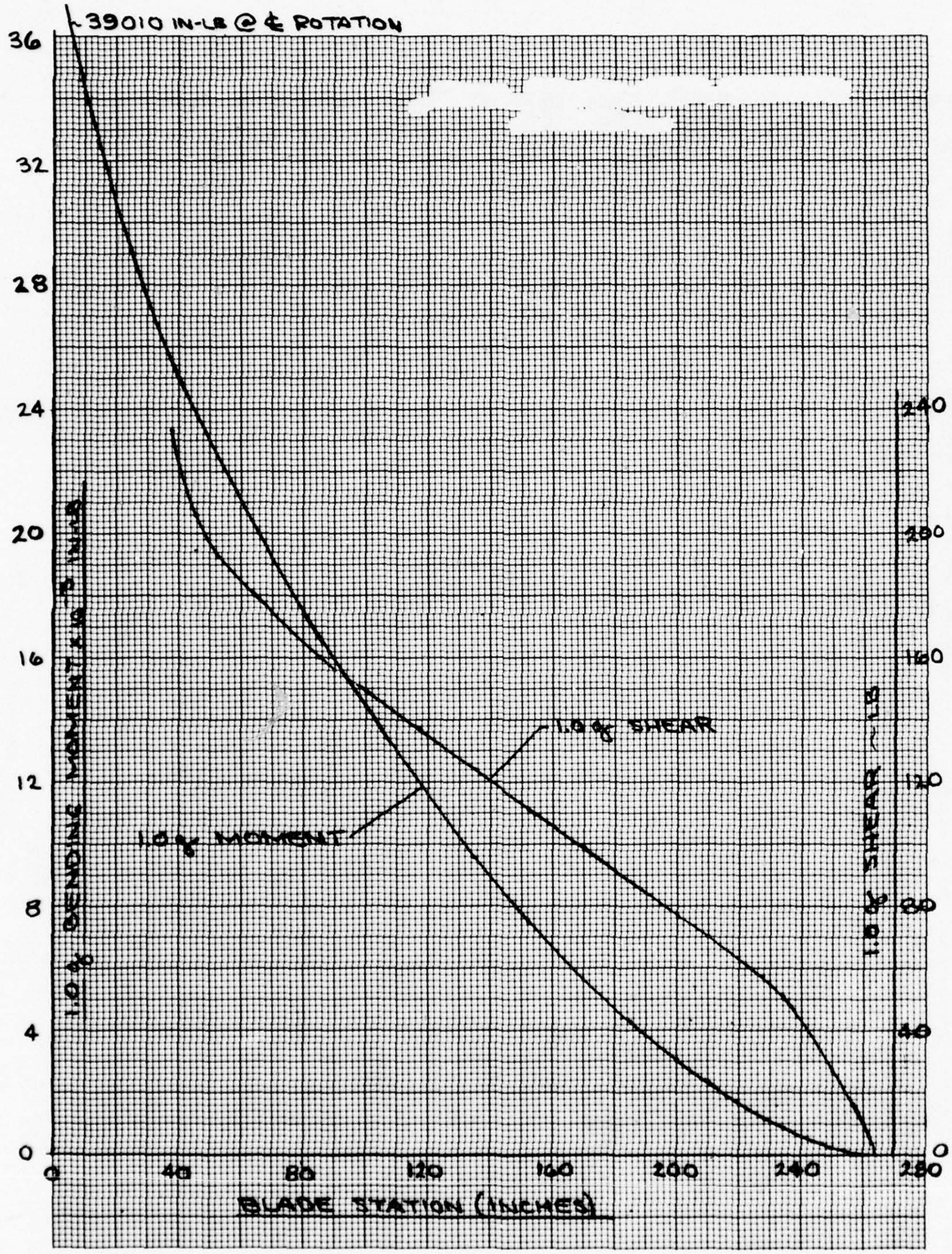


Figure B-9. 1.0g shear and moment curves.

REPORT TITLE ______ REPORT NO. 150-S-1001

PREPARED BY D. MANCILL OCT 14, 76 SUBJECT MODEL NO. ______

CHECKED BY ______ MTS BLADE

TABLE B-2. CENTRIFUGAL FORCE AND 1.0g SHEAR AND BENDING MOMENT

STA	ΔR	W/INCH	ΔV	V	ΔM	M SPAN	ΔCF 280 RPM	CENTRIFUGAL FORCE 280 RPM	324 RPM	356 RPM
264				0		0		0	0	0
	2.0	3.125	6.25		6.25		3661			
262				6.25		6.25		3661	4902	5918
	5.0	2.06	10.3		57		5953			
257				16.55		63.25		9614	12870	15540
	7.0	1.537	10.76		153.5		6075			
250				27.31		216.8		15689	21010	25360
	16	1.465	23.44		624.5		12634			
234				50.75		841.2		28320	37920	45780
	6	1.104	6.624		324.4		3408			
228				57.37		1166		31730	42490	51290
	18	.709	12.76		1148		6224			
210				70.13		2314		37960	50830	61360
	10	.712	7.12		736.9		3251			
200				77.25		3051		41210	55180	66620
	15	.713	10.70		1239		4588			
185				87.95		4290		45790	61310	74020
	15	.715	10.72		1400		4238			
170				98.67		5690		50030	66990	80880
	17.5	.720	12.60		1837		4525			
152.5				111.27		7527		54560	73050	88200
	17.5	.722	12.64		2058		4047			
135				123.91		9585		58600	78460	94730
	17.5	.726	12.70		2280		3571			
117.5				136.61		11865		62180	83260	100520
	17.5	.728	12.74		2502		3086			
100				149.35		14367		65260	87380	105490
	15	.730	10.95		2320		2256			
85				160.30		16687		67520	90410	109150
	19.5	.990	19.30		3314		3235			
65.5				179.6		20000		70750	94730	114370
	19.5	1.392	27.14		3767		3370			
46				206.74		23768		74120	99250	119820
	8.5	3.086	26.23		1869		2439			
37.5				232.97		25637		76560	102500	123760

$\Delta M = V_{AV}\,\Delta R$; $\Delta CF = \frac{\Delta V\, r}{386}\left\{280\,\frac{2\pi}{60}\right\}^2 = 2.2273\ \Delta V\, R$ @ 280 RPM

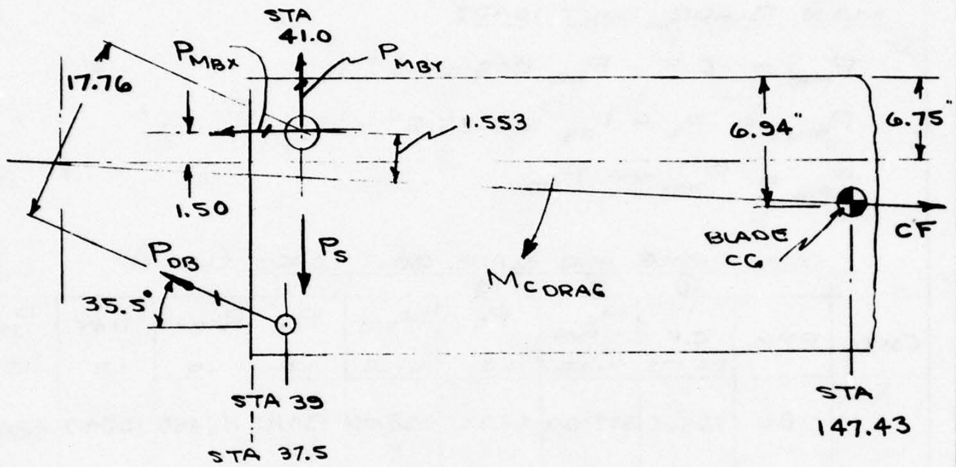
REPORT TITLE		REPORT NO. 150-S-1001
PREPARED BY D. MANCILL NOV 3, 76	SUBJECT	MODEL NO.
CHECKED BY	MTS BLADE	

TABLE B-3. ROTOR HUB 1.0g BENDING MOMENT AND SHEAR

STA	ΔR	Wt/INCH	ΔV	V	ΔM	M SPAN
39.6				225		25100
	13.2	6.875	90.75		3569	
26.4				315.75		28670
	13.2	6.900	91.08		4769	
13.2				406.83		33440
	13.2	3.326	43.90		5660	
0				450.73		39010

REPORT TITLE		REPORT NO.	150-S-1001
PREPARED BY U. MANCILL	NOV 19, 76	SUBJECT	MODEL NO.
CHECKED BY		MTS BLADE	

DRAG BRACE AND BLADE BOLT LOADS



CENTRIFUGAL FORCE MOMENT ARM ABOUT THE MAIN BOLT

FROM SIMILAR TRIANGLES:

$$\frac{CF_{ARM} - 1.50}{41} = \frac{6.94 - 6.75}{147.43} \qquad \therefore CF_{ARM} = 1.553"$$

$M_{C_{DRAG}}$ IS THE CHORD MOMENT DUE TO AIRLOAD DRAG.

MOMENT ABOUT THE MAIN BLADE BOLT

$$M_{MB} = M_{C_{DRAG}} - 1.553\ C.F.$$

DRAG BRACE LOAD

$$P_{DB} = -M_{MB}/17.76$$

P_S IS THE SHEAR LOAD DUE TO AIRLOAD DRAG.

REPORT TITLE		REPORT NO. 150-S-1001
PREPARED BY D. MANGILL NOV 19, 76	SUBJECT	MODEL NO.
CHECKED BY	MTS BLADE	

DRAG BRACE AND BLADE BOLT LOADS CONT'D.

MAIN BLADE BOLT LOAD:

$$P_{mBx} = C.F. - P_{DB} \cos 35.5^\circ$$

$$P_{mBY} = P_s - P_{DB} \sin 35.5^\circ$$

$$P_{mB} = P_{mBx} \overrightarrow{+} P_{mBY}$$

DRAG BRACE AND BLADE BOLT LOADS (LIMIT)

COND.	RPM	① C.F. STA 37.5	② M_c DRAG IN-LB	③ P_s LB	M_{MB} IN-LB	P_{DB} LB	P_{MBX} LB	P_{MBY} LB	P_{MB} LB
1	280	76560	357000	2272	238100	-13410	87480	10060	88060
2	280	76560	-195000	-1262	-313900	17670	62170	-11520	63230
3	356	123760	357000	2272	164800	-9279	131310	7660	131530
4	356	123760	-195000	-1262	-387200	21300	106420	-13630	107290
STARTING	0	0	55070	378	55070	-3100	2524	-1422	2897

① REF. PAGE 159

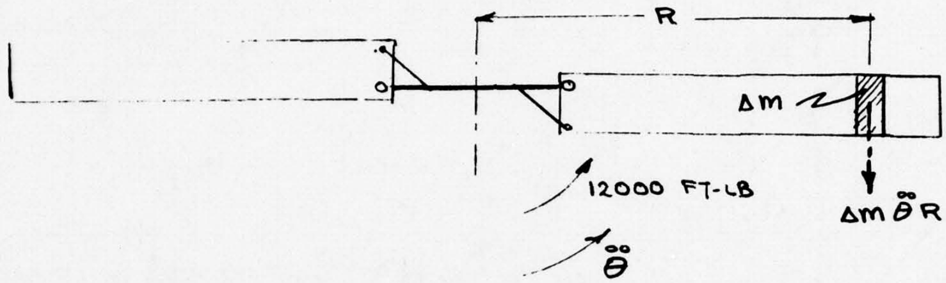
② REF 3, PAGE 2.15

③ REF 3., PAGE 2.01

$$P_s = (5.05 \times 10^{-3}) M_{co}$$

REPORT TITLE		REPORT NO. 150-S-1001
PREPARED BY D. MANCILL OCT 27, 76	SUBJECT	MODEL NO.
CHECKED BY	MTS BLADE	

ROTOR STARTING CONDITION



ESTIMATED MAXIMUM STARTING TORQUE @ ZERO RPM = 12000 FT-LB (144000 IN-LB) PER HUB
OR 72000 IN-LB PER BLADE

MASS MOMENT INERTIA OF THE MAIN ROTOR SYSTEM = 33946 IN-LB-SEC^2

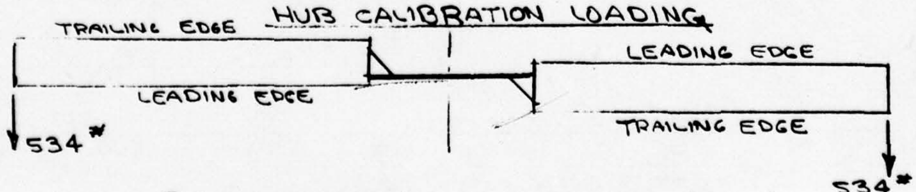
MAX. ANGULAR ACCELERATION DURING STARTING $\ddot{\theta} = \frac{T_{OR}}{I_\theta} = \frac{12000 \times 12}{33946}$

$\ddot{\theta} = 4.242$ RAD/SEC^2

SUBSTANTIATION OF BLADE FOR ROTOR STARTING LOADS

A 534 LB LOAD WAS APPLIED TO ~~THE~~ TIP (STA 264) OF EACH MTS BLADE DURING CALIBRATION AS SHOWN BELOW.

HUB CALIBRATION LOADING



MOMENT @ ℄ = 534 × 264 = 141,000 IN-LB / BLADE

AT THE CRITICAL STA 85 (SEE NEXT PAGE)

$M_{STARTING}$ = 60000 IN-LB ULT

M_{TEST} = 95000 IN-LB

$M.S. = \frac{95}{60} - 1 = +.58$

TRAILING EDGE BUCKLING

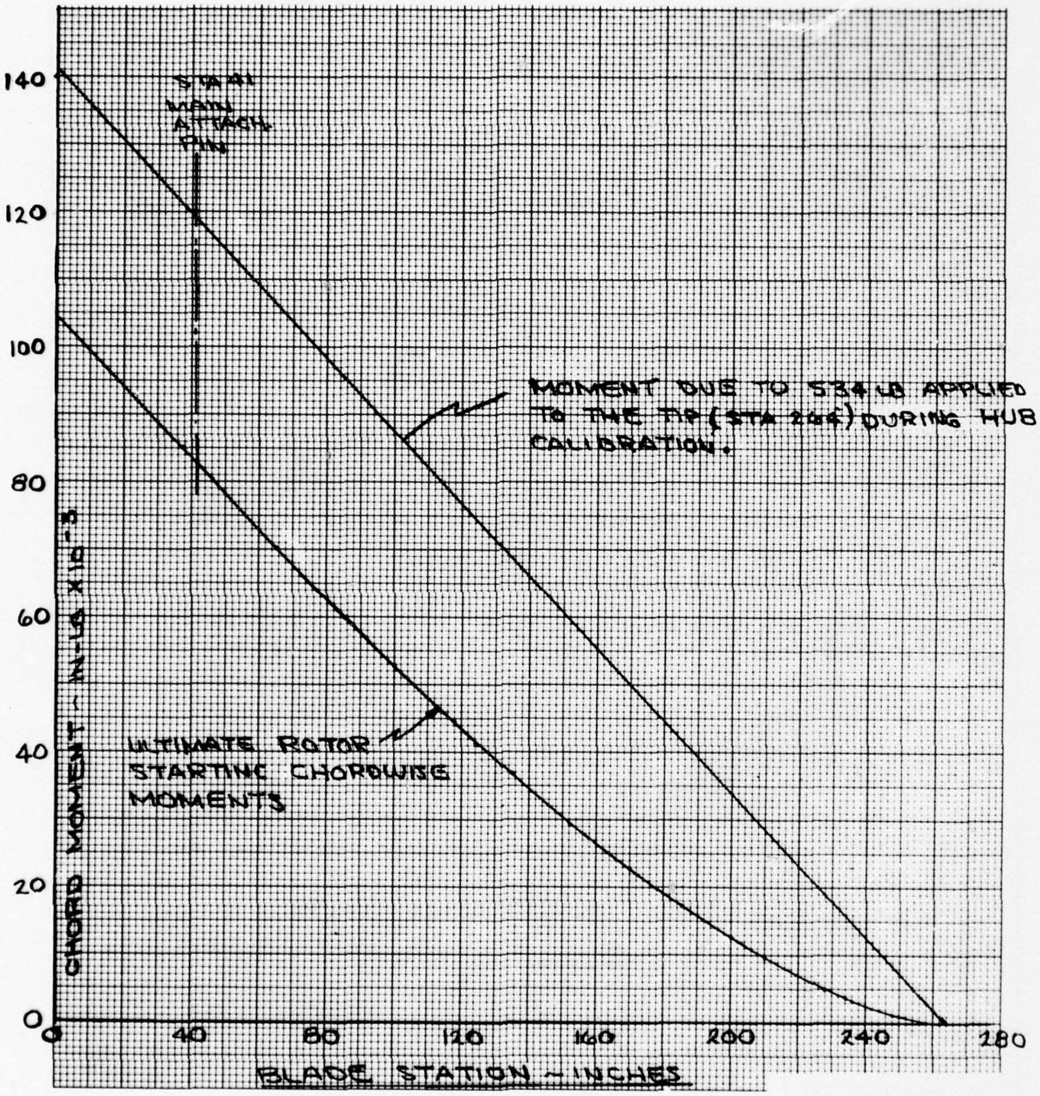


Figure B-10. Ultimate rotor starting chordwise moment compared to hub calibration loading.

REPORT TITLE ______ REPORT NO. 150-S-1001

PREPARED BY D. MANCILL OCT 27, '76 | SUBJECT | MODEL NO.

CHECKED BY ______ MTS BLADE

ROTOR STARTING LOADS (LIMIT)

STA	R	Δm	$\Delta m R^2$	ΔV $\ddot{\theta} R \Delta m$	V	ΔM	M
264					0		0
	263	.01619	1120	18.06		18.06	
262					18.06		18.06
	259.5	.02668	1797	29.37		163.7	
257					47.43		182
	253.5	.02788	1792	29.98		436.9	
250					77.41		619
	242	.06073	3557	62.34		1738	
234					139.8		2357
	231	.01716	915.7	16.82		889.2	
228					156.6		3246
	219	.03306	1586	30.71		3095	
210					187.3		6341
	205	.01845	775.4	16.04		1953	
200					203.3		8294
	192.5	.02772	1027	22.64		3220	
185					226		11514
	177.5	.02777	874.9	20.91		3547	
170					246.9		15061
	161.25	.03264	848.7	22.33		4516	
152.5					269.2		19580
	143.75	.03275	676.7	19.97		4886	
135					289.2		24460
	126.25	.03290	524.4	17.62		5215	
117.5					306.8		29680
	108.75	.03301	390.4	15.23		5502	
100					322.0		35180
	92.5	.02837	242.7	11.13		4914	
85					333.2		40090
	75.25	.0500	283.1	15.96		6652	
65.5					349.1		46750
	55.75	.07031	218.5	16.63		6969	
46					365.7		53720
	41.75	.06795	118.4	12.03		3160	
37.5					377.8		56880
	18.75	.640 (ESTIMATED)	225	50.90		15122	
0					428.7		72000

Σ 16973 $\Delta M = V_{AV} \Delta R$

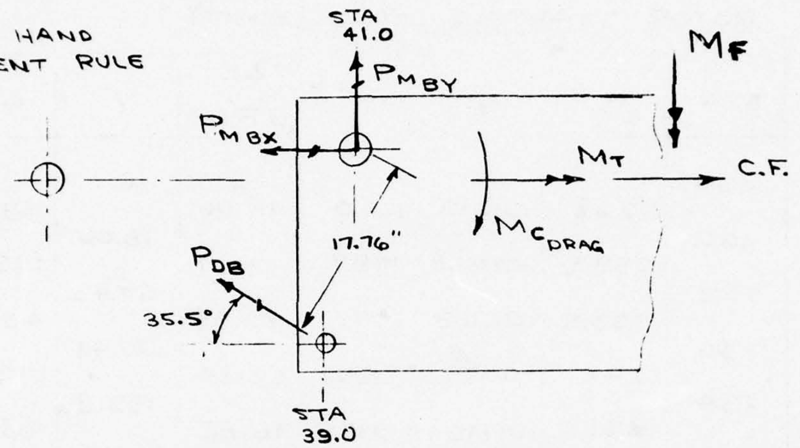
REPORT TITLE ______ REPORT NO. 150-S-1001

PREPARED BY D. MANCILL 2/4/76 SUBJECT MTS BLADE MODEL NO. ______

CHECKED BY ______

ROOT END ANALYSIS

RIGHT HAND MOMENT RULE



THE ROOT END ATTACHMENT OF THE BLADE UTILIZES A TWO PIN ATTACHMENT SCHEME SHOWN ABOVE. THE FORWARD PIN JOINT RESISTS THE MAJOR PORTION OF CENTRIFUGAL FORCE, FLAP BENDING MOMENT, TORSIONAL MOMENT, AND SHEAR LOADS. THE AFT PIN IS ATTACHED TO A DRAG BRACE AND WITH THE FWD PIN RESISTS THE CHORDWISE BENDING MOMENT.

LIMIT LOADS (REF. 3)

LOAD \ CONDITION	1	2	3	4	GROUNDING FLAPPING	ROTOR STARTING
$M_{C\,DRAG}$ IN-LB	357000	-195000	357000	-195000	0	55070
C.F. $_{STA\ 37.5}$ LB	76560	76560	123760	123760	0	0
M_{MB} IN-LB	238100	-313900	164800	-387200	0	55070
P_{DB} LB	-13410	17670	-9279	21300	0	-3100
P_{MBX} LB	87480	62170	131310	106420	0	2524
$P_{M\,BY}$ LB	10060	-11520	7660	-13630	0	-1422
P_{MB} LB	88060	63230	131530	107290	0	2897
M_F, IN-LB	62500	62500	-18000	-18000	-66800	-25000
M_T IN-LB	-39600	-39600	-39600	-39600	0	0

FROM MAX. MEASURED PITCH LINK LOAD, REF. 2, PAGE 222

REPORT TITLE ______ REPORT NO. 150-S-1001

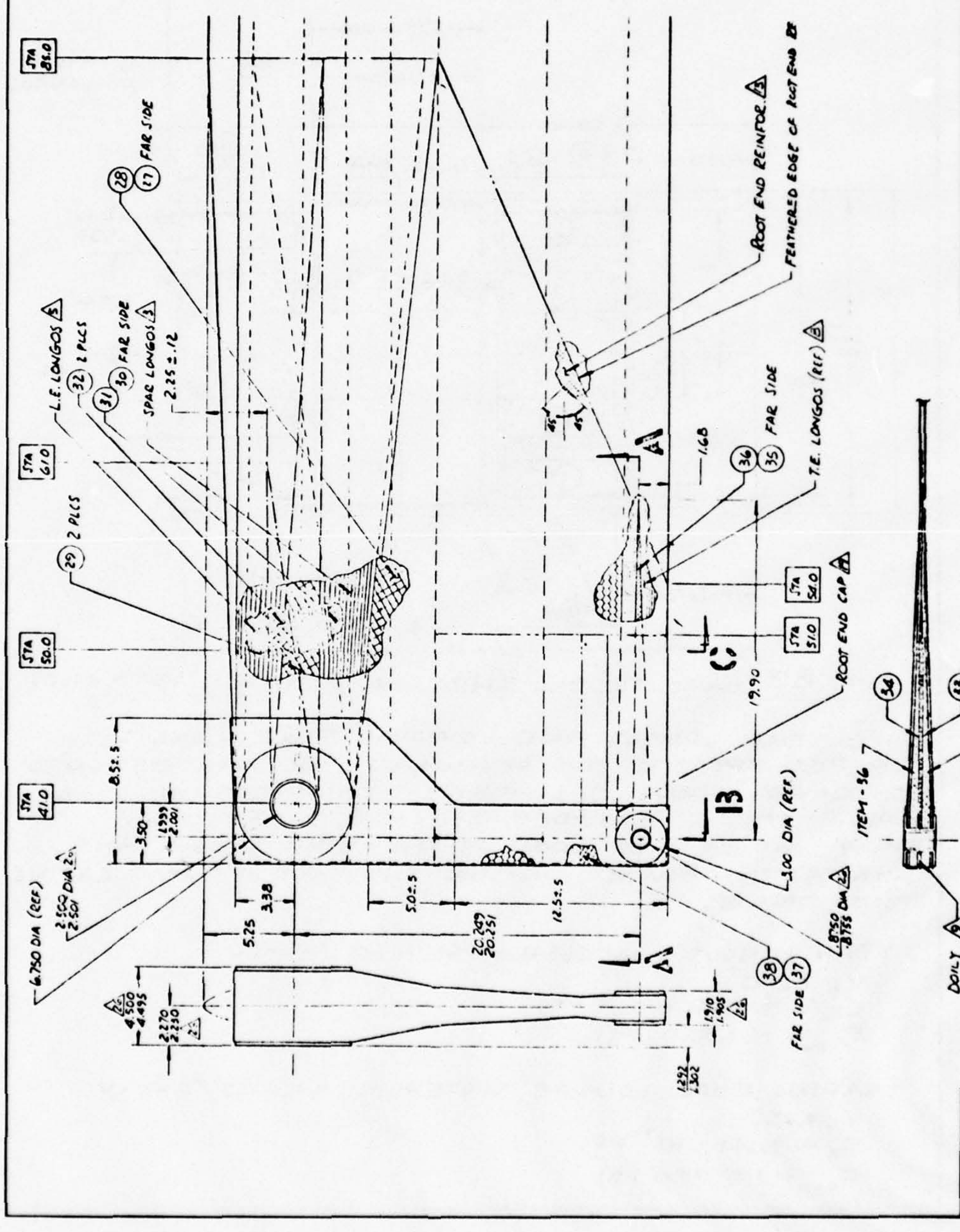
PREPARED BY P MANCILL 2/4/76

CHECKED BY ______

SUBJECT: MTS BLADE

MODEL NO. ______

ROOT END ANALYSIS

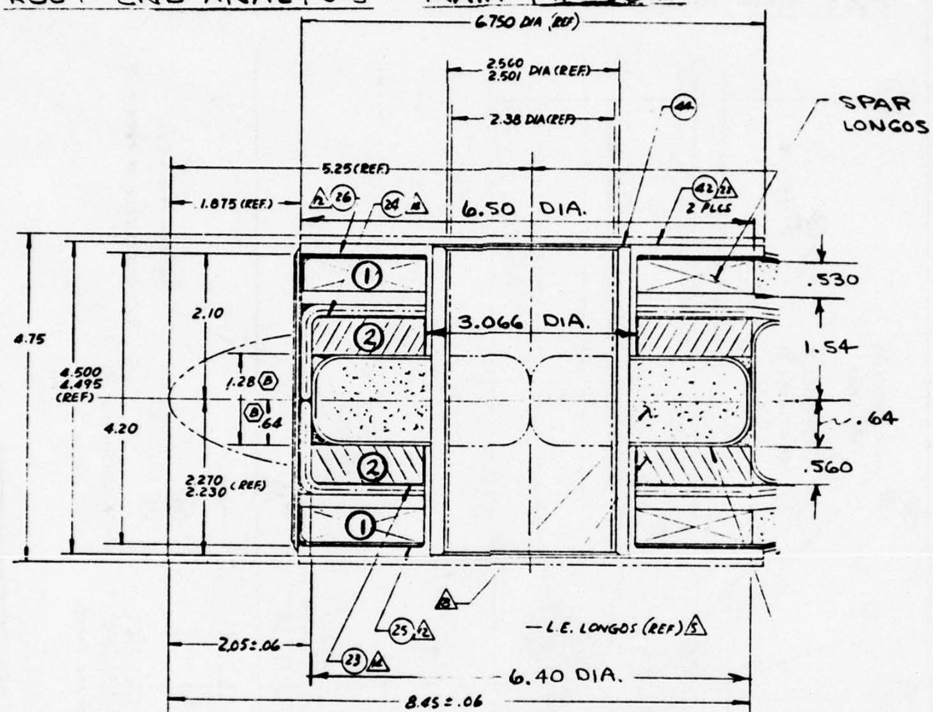


REPORT TITLE ______ REPORT NO. 150-S-1001

PREPARED BY D. MANCILL 2/4/76 SUBJECT MODEL NO. ______

CHECKED BY ______ MTS BLADE

ROOT END ANALYSIS ~ MAIN PIN JOINT



SEC. BB, CROSS SECTION THROUGH MAIN PIN (STA 41.0)

THE SPAR LONGOS AND LEADING EDGE LONGOS, DRAPED AROUND THE FORWARD PIN, ARE DESIGNED TO CARRY TENSILE LOADINGS. COMPRESSION LOAD CAPABILITY IS PROVIDED BY CHOPPED E-GLASS/EPOXY INSIDE THE LOOP OF THE SPAR LONGOS AND SYNTACTIC FOAM INSIDE THE LOOP OF THE LEADING EDGE LONGOS.

SPAR LONGOS MATERIAL: KEVLAR / EPOXY

$V_f = .50$

$E_x = 9.735 \times 10^{+6}$ PSI

$F_{x_{tu}} = 162{,}500$ PSI

LEADING EDGE LONGOS MATERIAL: S-GLASS/EPOXY

$V_f = .55$

$E_x = 7.141 \times 10^{+6}$ PSI

$F_{x_{tu}} = 178\,750$ PSI

REPORT TITLE ______ REPORT NO. 150-S-1001

PREPARED BY D. MANCILL 2-5-76 SUBJECT MODEL NO. ______

CHECKED BY ______ MTS BLADE

ROOT END ANALYSIS ~ MAIN PIN JOINT

SECTION PROPERTIES @ THE PIN HOLE, STA 41

ITEM NO.	ITEM	E_x PSI	A IN^2	EA_x LBS	I_B BEAM-WISE	EI_B $LBS-IN^2$
①	SPAR LONGOS	9.735	3.64	35.44	11.94	116.2
②	L.E. LONGOS	7.141	3.734	26.66	3.258	23.27

TOTAL $EI_B = 139.5 \times 10^{+6}$ #-IN^2 Σ 62.10 Σ 139.5

TOTAL $EA_x = 62.10 \times 10^{+6}$

STRENGTH SUMMARY AT THE MAIN PIN JOINT

ITEM	COND.	ULT LOADS		f_{ULT} KSI			ALLOW. STRESS KSI	MIN. MARGIN OF SAFETY
		P_{MB} KIPS	M_B IN-KIPS	DUE TO P_{MB}	DUE TO M_B	TOTAL		
SPAR LONGOS	1	132.1	93.75	20.7	13.74	$\boxed{34.44}$	129.3 (2)	+2.75
	4	160.9	-27.0	25.22	3.96	29.18		
	GROUND FLAPPING (3)	0	-99.7	0	15.17	15.17		
CHOPPED E-GLASS /EPOXY	GROUND FLAPPING (3)	0	-99.7	0	-16.99	-16.99	30.0	+.77 (3)
LEADING EDGE LONGOS	1	132.1	93.75	15.19	5.76	$\boxed{20.95}$	142.2 (2)	+5.79
	4	160.9	-27.0	18.50	1.66	20.16		

NOTES:

1., IN ADDITION, THE ROOT END HAS BEEN STATIC TESTED TO A CENTRIFUGAL OF 222,500 LBS, (COMPARED TO 181,500 LBS ULT. DESIGN) WITHOUT FAILURE

2., BASIC ALLOWABLE IS REDUCED, SINCE THE UNIDIRECTIONAL FIBERS ARE WRAPPED AROUND A BUSHING. REDUCTION FACTOR IS BASED ON HUGHES TESTING

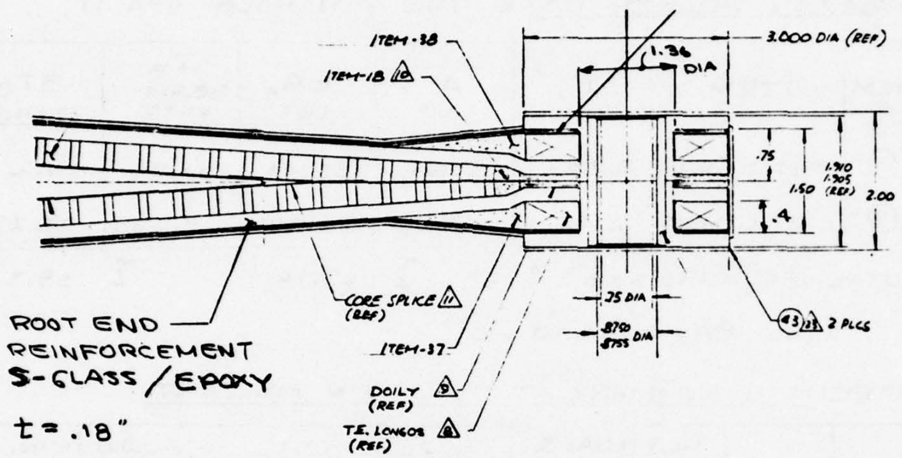
3., BLADE GROUND FLAPPING LOADS ARE REACTED BY THE UPPER SPAR LONGOS LUG AND THE LOWER CHOPPED E-GLASS/ EPOXY LUG. THE STRENGTH OF THE SYNTACTIC FOAM HAS BEEN CONSERVATIVELY NEGLECTED.

REPORT TITLE ______ REPORT NO. 150-S-1001

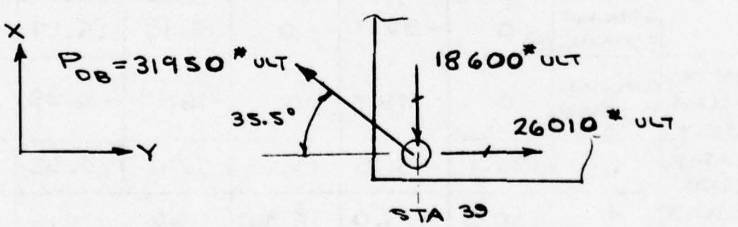
PREPARED BY D. MANGILL 2-5-76 SUBJECT MODEL NO. ______

CHECKED BY ______ MTS BLADE

ROOT END ANALYSIS ~ AFT DRAG BRACE ATTACH POINT



MAXIMUM DRAG BRACE LOAD = 21300 * LIMIT COND. 4
REF PG 188
OR 31950 * ULT



THE AXIAL LOAD IN THE X-DIRECTION IS CARRIED BY THE S-GLASS/EPOXY REINFORCEMENT; THE TENSION LOAD IN THE Y-DIRECTION IS CARRIED BY THORNEL 300/EPOXY TRAILING EDGE LONGOS WHICH ARE DRAPED AROUND THE PIN; AND THE COMPRESSION LOAD IN THE Y-DIRECTION IS CARRIED BY CHOPPED E-GLASS/EPOXY FILLER INSIDE THE LOOP OF THE TRAILING EDGE LONGOS AND THE S-GLASS/EPOXY REINFORCEMENT.

REPORT TITLE			REPORT NO. 150-S-1001
PREPARED BY D. MANCILL	2-6-76	SUBJECT	MODEL NO.
CHECKED BY		MTS BLADE	

ROOT END ANALYSIS ~ AFT DRAG BRACE ATTACH POINT

S-GLASS/EPOXY REINFORCEMENT

S-GLASS ROVING FERRO S-1014 ; $\alpha = \pm 45°$

LAMINATE THICKNESS = .18" $V_f = .50$

$F_{x\,TU} = 40030$ PSI
$F_{x\,CU} = 29600$ PSI } FROM "PROP" PROGRAM IN THE APPENDIX. REF PG 67

FOR 3.50" EFFECTIVE WIDTH AND $P = -18600^{\#}$ ULT

$$f_c = \frac{18600}{2 \times 3.5 \times .18} = 14760 \text{ PSI}$$

$$M.S. = \frac{29600}{14760} - 1 = +\underline{1.01}$$

COMP.

THORNEL 300/EPOXY TRAILING EDGE LONGOS

TOTAL LUG AREA = $2 \times .40[3.00 - 1.36] = 1.312 \text{ IN}^2$

$$f_{tu} = \frac{P}{A} = \frac{26010}{1.312} = 19800 \text{ PSI}$$

$F_{x\,TU} = 162{,}500$ PSI (PG 69) THIS ALLOWABLE FROM APPENDIX IS REDUCED SINCE THE UNIDIRECTIONAL FIBERS ARE WRAPPED AROUND A BUSHING. REDUCTION FACTOR BASED ON HUGHES TESTING

REDUCED $F_{xtu} = .73 \times 162{,}500 = 118600$ PSI

$$M.S. = \frac{118600}{19800} - 1 = \underline{\text{LARGE}}$$

TENSION

CHOPPED E-GLASS/EPOXY FILLER

MAX. COMP. DRAG BRACE LOAD = $-20120^{\#}$ ULT

∴ LOAD ACTING ON THE FILLER = $20120 \cos 35.5° = -16380$ ULT

$$f_c = \frac{P}{A} = \frac{16380}{2 \times .4 \times 1.36} = 15060 \text{ PSI} \qquad F_c = 30{,}000 \text{ PSI}$$

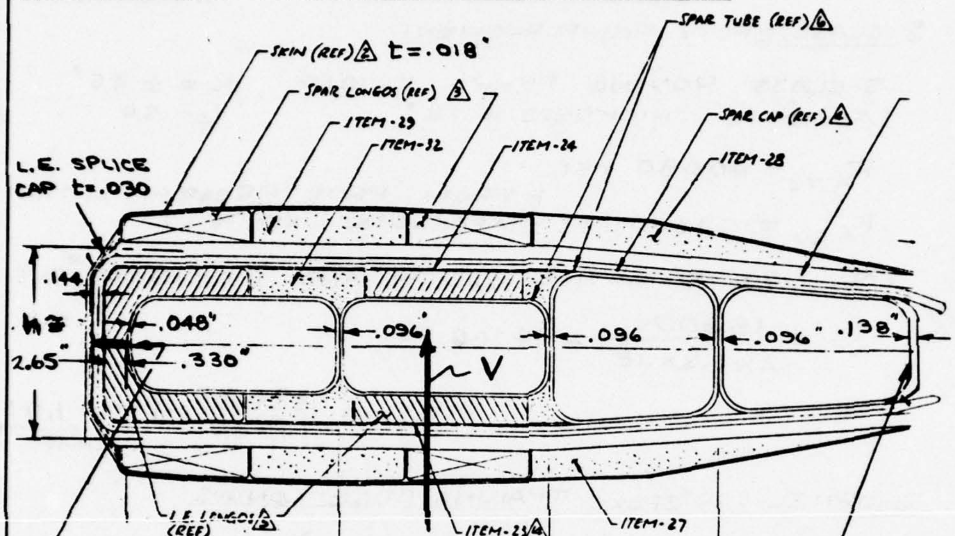
THIS ANALYSIS IS CONSERVATIVE SINCE THE S-GLASS/EPOXY REINFORCE. HAS NOT BE INCLUDED.

$$M.S. = \frac{30{,}000}{15060} - 1 = +\underline{.99}$$

BEARING

REPORT TITLE		REPORT NO. 150-S-1001
PREPARED BY D. MANCILL	2/12/76	SUBJECT MTS BLADE / MODEL NO.
CHECKED BY		

STATION 50 VERTICAL SHEAR ANALYSIS



STATION 50, WITH THE SMALLEST WIDTH OF FILM ADHESIVE BOND LINE, IS THE CRITICAL BLADE STATION.

$V = 2.67 \times 1.5 \times 192 = 769$ # ULT (2.67 g's LIMIT GROUND FLAPPING COND)

$V = \frac{\Delta M}{\Delta R} = 1.5\left(\frac{10{,}000}{8.0}\right) = 1875$ # ULT (ESTIMATED FROM FLAPWISE MOMENT DIAGRAM COND 1&2 REF 3 PAGE 2.04)

TOTAL SHEAR THICKNESS $= .030 + .144 + .330 + .048 + 3(.096) + .138$

$= .978 \text{ IN}^2$

$f_{su} \cong \frac{V}{h\,t_{TOT}} = \frac{1875}{2.65 \times .978} = 723 \text{ PSI}$

$F_{su} = 1420$ PSI (KEVLAR-49 LAP SHEAR TESTS @ HUGHES GAVE 1420 TO 2120 PSI FAILURE POINTS.)

* FILM ADHESIVE (FR-7035) VACUUM MATERIAL, 1 MIL THICK BONDABLE BOTH SIDES	$M.S. = \frac{1420}{723} - 1 = +.96$ BOND SHEAR

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PREPARED BY D. MANCILL 2/3/76	SUBJECT: MTS BLADE — MODEL NO.
CHECKED BY	

BLADE STATION 85

STATION 85 IS THE CRITICAL BASIC BLADE SECTION SINCE OUTBOARD OF THIS SECTION THE LOADS ARE LESS AND INBOARD, THE STRESSES ARE LESS (DUE TO LARGE INCREASES IN BOTH FLAPWISE AND CHORDWISE SECTION MODULI).

LIMIT LOADS @ STA 85

CONDITION	1	2	3	4
LIMIT LOADS — VERTICAL G's	+3.5	+3.5	-0.5	-0.5
LIMIT LOADS — RPM	280	280	356	356
CENTRIFUGAL FORCE - LBS	67400	67400	109,000	109,000
FLAPWISE MOMENT IN-LBS	21000	21000	-29200	-29200
CHORDWISE MOMENT IN-LBS (4)	401700	-260	489040	85040
TORSION MOMENT IN-LBS	-35000	-35000	-35000	-35000

NOTES:

(1). REFERENCE 2 (LIMIT LOAD ANALYSIS) FOR CHORDWISE MOMENT AND COND. 1&2 FLAPWISE MOMENT.

(2) REFERENCE 1 (MEASURED FLIGHT LOADS) FOR COND. 3&4 FLAPWISE MOMENTS. MEASURED FLIGHT LOADS WERE FOUND TO EXCEED LIMIT LOADS FOR THESE PARTICULAR CONDITIONS.

(3) LOAD SIGN CONVENTION:

FLAPWISE MOMENT - POSITIVE DENOTES TENSION IN THE LOWER SIDE OF BLADE

CHORDWISE MOMENT - POSITIVE DENOTES TENSION IN LEADING EDGE OF BLADE.

TORSION MOMENT - POSITIVE DENOTES NOSE UP.

(4) MODEL 540 CHORD LOADS MODIFIED ON NEXT PAGE FOR MTS BLADE.

SECTION PROPERTIES @ STA 85

AXIAL STIFFNESS, $EA = 55.0 \times 10^{+6}$ LBS

FLAPWISE STIFFNESS, $EI_B = 24.8 \times 10^{+6}$ LBS-IN^2

CHORDWISE STIFFNESS, $EI_c = 3890 \times 10^{+6}$ LBS-IN^2

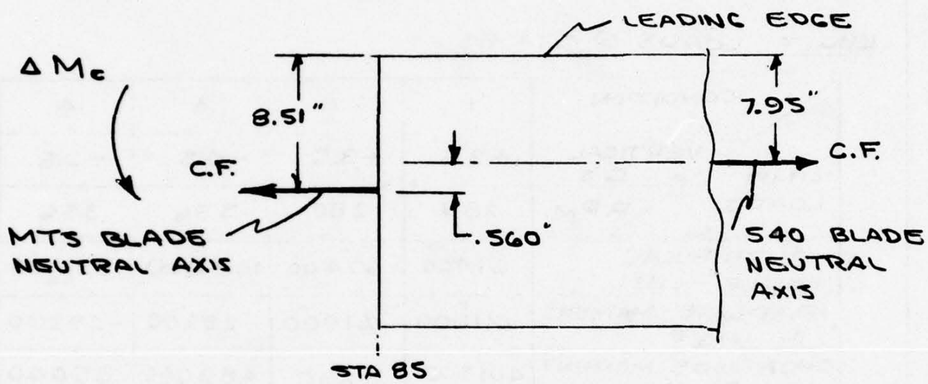
REPORT TITLE ______ REPORT NO. 150-S-1001

PREPARED BY D. MANGILL 9/15/76 SUBJECT MTS BLADE MODEL NO. ______

CHECKED BY ______

BLADE STATION 85

THE CHORDWISE MOMENT FROM REFERENCE 2 (LIMIT LOAD 540 BLADE ANALYSIS) MUST BE MODIFIED TO ACCOUNT FOR THE .560 INCH AFT SHIFT OF THE NEUTRAL AXIS.



$\Delta M_c = .560\ C.F.$

LIMIT LOADS \ CONDITION	1	2	3	4
CENTRIFUGAL FORCES	67400	67400	109000	109000
ΔM_c	37740	37740	61040	61040
$M_{c\ 540}$	364000	-38000	428000	24000
$M_{c\ MTS}$	401700	- 260	489040	85040

REPORT TITLE

PREPARED BY D. MANCILL 2/3/76

CHECKED BY

REPORT NO. 150-S-1001

MODEL NO.

SUBJECT MTS BLADE

STRENGTH SUMMARY AT THE CRITICAL BLADE STATION 85

ITEM	CRITICAL CONDITION	POINT	BEAMWISE BENDING C INCHES	BEAMWISE BENDING f_B ULT PSI	CHORDWISE BENDING C INCHES	CHORDWISE BENDING f_B ULT PSI	f_t TOTAL ULT PSI	F'_{tu} (1) PSI	f_{su} PSI	F'_{su} (2) ULT	MINIMUM MARGIN OF SAFETY
LEADING EDGE LONGOS	3	A	0	0	8.316	11200	32420	178750	—	—	4.51 TENSION
		B	1.00	12610	5.01	6750	40580	177870	1090	10700	3.38 TENSION
SPAR TUBE	3	B	1.0	2820	5.01	1512	9087	25440	3574	11540	1.80 TENSION
OUTER SKIN, SPAR CAP	3	C	.65	967	7.510	1200	4678	12540	6877	14880	1.10 SHEAR
SPAR	3	D	1.26	6630	3.660	2060	17530	39930	5244	10470	0.95 SHEAR
OUTER SKIN	4	E	1.0	2895	4.290	-231	7554	25320	2480	10500	2.35 TENSION
C-CHANNEL	4	F	.75	2220	4.290	-236	6979	36300	9288	31150	2.30 SHEAR
AFT TUBE	4	G	.50	1340	5.14	-256	5600	22410	2083	10630	3.00 TENSION
TRAILING EDGES LONGOS	4	H	.19	5775	15.99	-9034	47970	162500	—	—	2.39 TENSION
		I	0	0	18.49	-10450	40770	162500	—	—	2.99 TENSION

(1) THE ALLOWABLE TENSILE STRENGTH COMBINING SHEAR IS

$$F'_{tu} = \sqrt{F_{tu}^2 - \left(\frac{F_{tu}}{F_{su}}\right)^2 f_{su}^2}$$

(2) THE ALLOWABLE SHEAR STRENGTH COMBINING TENSION IS

$$F'_{su} = \sqrt{\left(F_{tu}^2 - f_t^2\right)\left(\frac{F_{su}}{F_{tu}}\right)^2}$$

REFERENCE 5, PAGE 30 FOR THE ABOVE EQUATIONS.

---

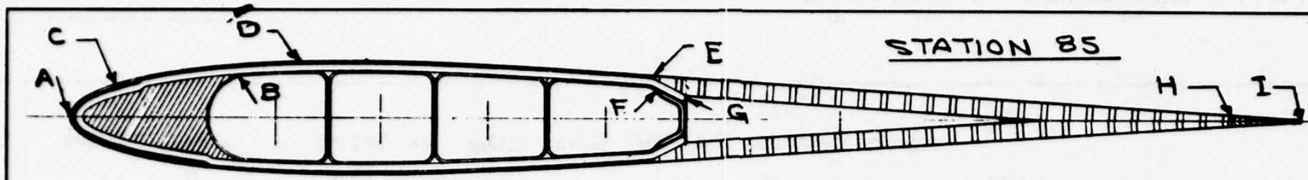
[5] Francis, P.H. and Ko, W.L., SURVEY OF THE LITERATURE ON STRENGTH CHARACTERIZATION OF FIBER REINFORCED COMPOSITE MATERIALS; AFOSR Scientific Report, AFOSR-TR-71-2437, November 1970.

REPORT TITLE ____________ REPORT NO. 150-3-1001

PREPARED BY D. MANCILL 2/2/76 SUBJECT MTS BLADE MODEL NO. ____

CHECKED BY ____________

STATION 85



CENTRIFUGAL FORCE STRESSES

ITEM	MATERIAL	POINT	$E_x \times 10^{-6}$	LIMIT C.F. STRESS PSI FATIGUE 324 RPM	LIMIT C.F. STRESS PSI MAX. 356 RPM	F_{tu} SEE APPENDIX PSI
LEADING EDGE LONGOS	S-GLASS/EPOXY FIBER VOL.= 55%	A B	7.141	11640	14150	178750
SPAR TUBE	KEVLAR 49/EPOXY 6 PLIES OF ±45°, 2 PLIES OF 90°	B	1.601	2626	3170	26600
OUTER SKIN, SPAR CAP	KEVLAR 49/EPOXY 24 PLIES OF ±45°, 3 PLIES OF 90°	C	.845	1390	1677	13970
OUTER SKIN, SPAR LONGO, SPAR CAP, SPAR TUBE	KEVLAR 49/EPOXY 8 PLIES OF 0° 30 PLIES OF ±45° 5 PLIES OF 90°	D	2.980	4895	5910	45090
OUTER SKIN	KEVLAR 49/EPOXY 2 PLIES OF ±45°, 1 PLY OF 90°	E	1.643	2700	3260	25990
C-CHANNEL	E-GLASS/EPOXY $\alpha = \pm 45°$	F	1.679	2758	3330	37970
AFT TUBE	S-GLASS/EPOXY $\alpha = \pm 55°$	G	1.521	2493	3010	22450
TRAILING EDGE LONGOS	THORNEL 300 GRAPHITE/EPOXY	H I	17.23	28290	34150	162500

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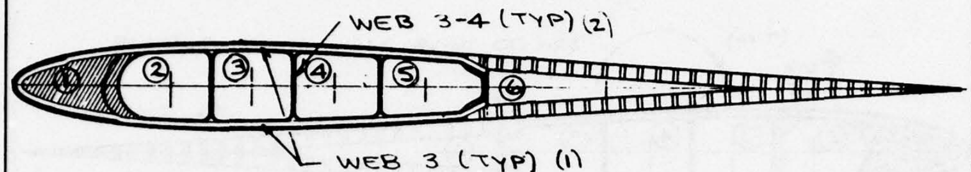
PREPARED BY D. MANCILL	1/29/76	SUBJECT	MODEL NO.
CHECKED BY		MTS BLADE	

STATION 85 TORSION ANALYSIS



WEB SUMMARY

WEB	MATERIAL	WEB THICKNESS INCH
1	KEVLAR 49/ EPOXY { 24 PLIES OF ±45° / 3 PLIES OF 90°	.162
1-2	S-GLASS/EPOXY LONGOS	.20 (ASSUMED)
2	KEVLAR 49/ EPOXY { 8 PLIES OF 0° / 30 PLIES OF ±45° / 5 PLIES OF 90°	.254
2-3	KEVLAR 49/ EPOXY 12 PLIES OF ±45° / 4 PLIES OF 90°	.096
3	SAME AS 2	.254
3-4	SAME 2-3	.096
4	SAME AS 2	.254
4-5	SAME AS 2-3	.096
5	SAME AS 2	.254
5-6	E-GLASS CHANNEL $\alpha = \pm 45°$	.080
6	OUTER SKIN KEVLAR 49/ EPOXY { 2 PLIES OF ±45° / 1 PLY OF 90°	.018
	AFT TUBE S-GLASS $\alpha = \pm 55°$	.010

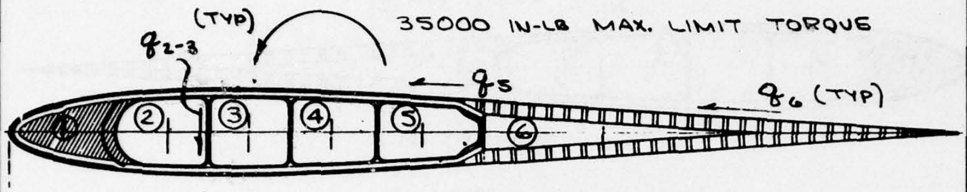
(1) WEB 3 IS THE OUTSIDE WALL FOR CELL 3.
(2) WEB 3-4 IS THE INTERIOR WALL BETWEEN CELLS 3 AND 4.

REPORT TITLE ______ REPORT NO. 150-S-1001

PREPARED BY D. MANCILL 1/29/76 SUBJECT MODEL NO.

CHECKED BY ______ MTS BLADE

STATION 85 TORSION ANALYSIS CONT'D.



THE MAXIMUM MEASURED TORQUE (BASED ON PITCH LINK LOAD RATIOED TO STA. 85) IS 35000 IN-LBS REFERENCE 2, PAGE 222, COND 71. BASED ON THIS TORQUE, THE SHEAR FLOWS WERE CALCULATED BY THE HUGHES COMPUTER PROGRAM "BOX" (SEE APPENDIX, p. 195)

SUMMARY OF SHEAR STRESSES

← SEE APPENDIX

WEB		q ULT #/INCH	t INCH	f_{su} ULT #/IN^2	F_{su} #/IN^2	R_s f_{su}/F_{su}
1		1114	.162	6877	15580	.441
1-2		217.9	.20	1090	10970	.0994
2		1332	.254	5244	11290	.464
2-3		19.25	.096	200	12217	.0164
3		1313	.254	5169	11290	.458
3-4		161.2	.096	1679	12217	.137
4		1151	.254	4531	11290	.401
4-5		343.1	.096	3574	12217	.293
5		808.4	.254	3183	11290	.282
5-6		743	.080	9288	31720	.293
6	OUTER SKIN	44.62	.018	2480	11000	.225
6	INNER TUBE	20.83	.010	2083	34600	.0602

REPORT TITLE			REPORT NO. 150-S-1001
PREPARED BY D. Mancill 2-9-76		SUBJECT	MODEL NO.
CHECKED BY		MTS BLADE	

BLADE TIP

The tip weights are attached to the blade by a combination of both bond shear and mechanical locking. The two load paths are as follows:

1. NOSE TIP WEIGHT

   a. The nose tip weight is bonded to the inside surface of the spar and forward surface of the forward spar tube.

   b. A continuous band of leading edge S-glass longos (impregnated with resin) wraps around the nose tip weight thus mechanically locking in the weight.

2. Middle and aft tip weights

   a. Each tip weight is bonded to the syntactic foam which is bonded to the inside surfaces of the spar tubes.

   b. A continuous band of Kevlar fibers impregnated with wet resin and under a tension force is wound on the tip weight fitting in one continuous operation. These Kevlar fibers, applied at a wrap angle of $\pm$ 45 degrees, interlace around the bottle-top shape of the outboard end of the tip weights, and are followed by the circumferential wraps, resulting in an effective mechanical lock of the tip fitting to the spar tube. Under centrifugal force, the elastic deformation of the $\pm 45^o$ wraps is to contract and tighten on the tip weight fittings.

The structural strength of these methods of attachment has been successfully demonstrated by the MTS blade tip start-stop test. This test applied the simulated centrifugal force of 324 RPM (max. power on operating rotor speed) to the tip weights for 1200 cycles. Substantiation of the tip weight attachment strength at 356 rpm (max. design rotor speed) is presented herein.

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REPORT TITLE

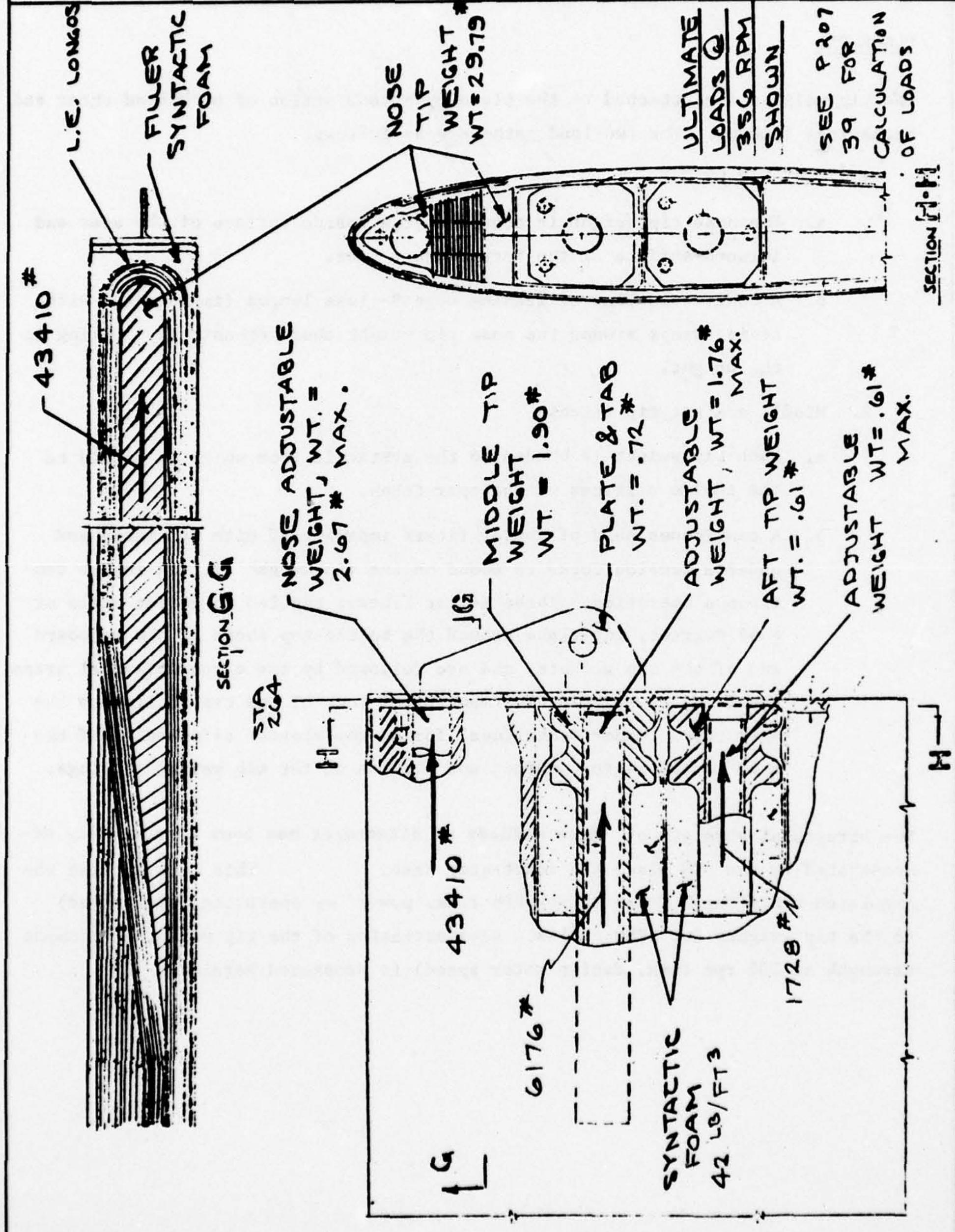
REPORT NO. 150-S-1001

PREPARED BY D. MANCILL OCT 6, 76

SUBJECT MTS BLADE

MODEL NO.

CHECKED BY



REPORT TITLE	REPORT NO. 105-S-1001
PREPARED BY D. MANCILL OCT 7, 76	SUBJECT MTS BLADE / MODEL NO.
CHECKED BY	

BLADE TIP

LOADS

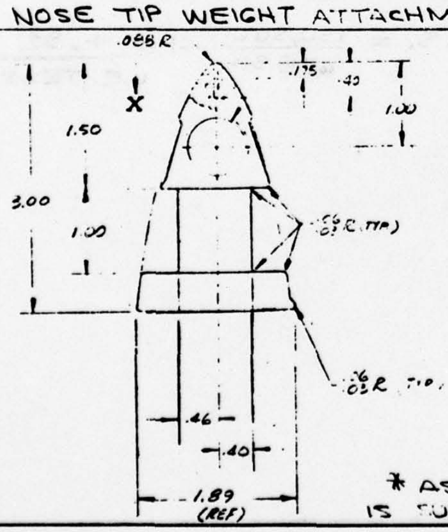
MAXIMUM DESIGN ROTOR SPEED ———— 356 RPM
MAXIMUM POWER ON OPERATING ROTOR SPEED ———— 324 RPM

$$CF = \frac{W}{g} r \omega^2$$

CENTRIFUGAL LOADS ~LB

ITEM	WEIGHT LB	r INCHES	CF LIMIT 324 RPM	CF ULTIMATE 356 RPM
NOSE TIP WEIGHT PLUS 2.67 LB. OF ADJUSTABLE WT.	29.79 2.67	246.77 257.50	23970	43410
MIDDLE TIP WEIGHT PLUS 1.76 LB OF ADJ. WT. AND .72 LB PLATE AND TAB	4.38	261.12	3410	6176
AFT TIP WEIGHT PLUS .61 LB OF ADJUSTABLE WT.	1.22	262.26	954	1728

NOSE TIP WEIGHT ATTACHMENT



$P_{APPLIED} = 43410^{*}$ ULT

TOTAL BOND AREA $\cong 6.0 \times 37 = 222\ IN^2$

$$f_{su} = \frac{P}{A} = \frac{43410}{222} = 196^{*}\ \#/IN^2$$

AVERAGE SHEAR STRESS

$F_{su} = 1000$ PSI

$$M.S. = \frac{1000}{196} - 1 = \text{LARGE}$$

BOND SHEAR

* ASSUMES ALL THE LOAD IS SUPPORTED IN BOND SHEAR

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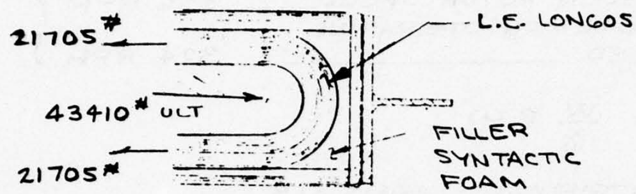
CHECKED BY	MTS BLADE

BLADE TIP

NOSE TIP WEIGHT ATTACHMENT CONT'D.



THIS LOAD PATH ASSUMES ALL THE LOAD IS CARRIED BY THE LEADING EDGE LONGOS.

AREA OF THE L.E. LONGOS WHICH WRAPS AROUND THE WEIGHT = 1.0 X .32 = .32 IN²

$$f_{tu} = \frac{P}{2A} = \frac{43410}{2 \times .32} = 67830 \text{ PSI}$$

$V_f = .55$

FOR S-GLASS LONGOS $F_{tu} = 178750$ PSI

THIS ALLOWABLE WILL BE REDUCED SINCE THE FIBERS ARE WRAPPED AROUND THE WEIGHT. REDUCTION FACTOR IS BASED ON HUGHES TESTING (REF 7).

REDUCED $F_{tu} = .73 \times 178750 = 130{,}500$ PSI

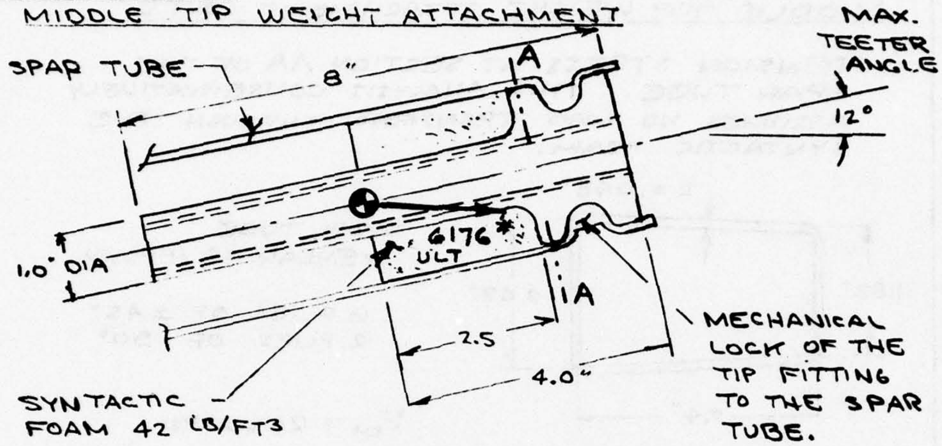
$$M.S. = \frac{130{,}500}{67830} - 1 = \underline{+.92}$$

L.E. TENSION

REPORT TITLE		REPORT NO. 150-S-1001
PREPARED BY D. MANCILL OCT 8, 76	SUBJECT	MODEL NO.
CHECKED BY	MTS BLADE	

BLADE TIP

MIDDLE TIP WEIGHT ATTACHMENT



THIS LOADING CONDITION ASSUMES THAT THE BLADE IS AGAINST THE UP TEETERING STOP (12°) AND IS ROTATING AT 356 RPM.

SHEAR LOAD $= P_S = 6176 \sin 12° = 1284$ * ULT

THE BEARING STRESS ON THE SYNTACTIC FOAM

$$f_{BRU} = \frac{P}{A} + \frac{Mc}{I} = \frac{1284}{1 \times 2.5} + \frac{1284 \times 1.25 \times 1.25 \times 12}{1.0(2.5)^3}$$

$$f_{BRU} = 2054 \text{ PSI}$$

TYPICAL COMPRESSION STRENGTH = 9500 PSI

USE A STRENGTH REDUCTION FACTOR OF 2

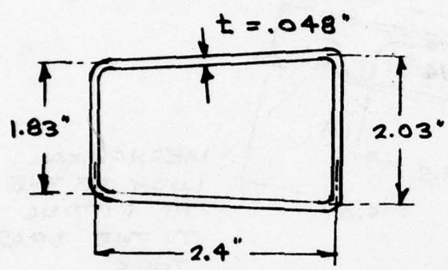
$$M.S. = \frac{9500}{2 \times 2054} - 1 = \underline{1.31}$$

BEARING ON THE SYNTACTIC FOAM

REPORT TITLE		REPORT NO. 150-S-1001	
PREPARED BY D. MANCILL	OCT 8, 76	SUBJECT	MODEL NO.
CHECKED BY		MTS BLADE	

BLADE TIP
MIDDLE TIP WEIGHT ATTACHMENT CONT'D.

TENSION STRESS AT SECTION AA OF THE SPAR TUBE. THIS ANALYSIS CONSERVATIVELY ASSUMES NO LOAD TRANSFER THROUGH THE SYNTACTIC FOAM.



SECTION AA

SPAR TUBE
KEVLAR 49 /EPOXY

6 PLIES OF ±45°
2 PLIES OF 90°

$F_{tu} = 26600$ PSI

$P = 6176^{\#}$ ULT
AREA = .4157 IN²

$$f_{tu} = \frac{P}{A} = \frac{6176}{.4157} = 14860 \text{ PSI}$$

$$M.S. = \frac{26600}{14860} - 1 = +\underline{.79}$$

TENSION IN SPAR TUBE

AFT TIP WEIGHT ATTACHMENT

$P_{APPLIED} = 1728^{\#}$ ULT AFT TIP WEIGHT LOAD

$P_{APPLIED} = 6176^{\#}$ ULT MIDDLE TIP WEIGHT LOAD

THE AFT TIP WEIGHT ATTACHMENT IS LESS CRITICAL THAN THE MIDDLE SINCE THE STRENGTH OF BOTH ATTACHMENT STRUCTURES ARE IDENTICAL AND THE AFT LOAD IS 28% OF THE MIDDLE ATTACHMENT LOAD.

REPORT TITLE MTS Main Rotor Blade Assy, Structural Analysis Report		REPORT NO. 150-S-1001	
PREPARED BY D. H. Mancill 12/76	SUBJECT		MODEL NO.
CHECKED BY	MTS Blade		

BLADE L-N FATIGUE CURVES

The results of the Hughes' bench testing of three (3) MTS full-scale blade assemblies were used to develop the L-N curves in this report. This laboratory testing applied simultaneously cyclic fapwise, chordwise, and torsional moments as well as steady chordwise moment and centrifugal force to the blade assemblies. To account for scatter in fatigue data, the mean L-N curves were reduced statistically by the following factors to yield the design curves for life calculations:

L-N Curve Reduction Factors

Number of Fatigue Test Specimens	Reduction to Mean L-N Curve	Blade Loading Item
2	70%	Root End Torque
3	80%	Remaining Items

It should be noted that run-out points were conservatively assumed to be failures to generate the L-N curves (i.e. there were no fatigue failures in this blade fatigue test program).

See Figures 72 through 78.

REPORT TITLE	MTS Main Rotor Blade Assy, Structural Analysis Report	REPORT NO.	150-S-1001
PREPARED BY	D. H. Mancill 12/76	SUBJECT	MODEL NO.
CHECKED BY		MTS Blade	

COMPARATIVE TIP DEFLECTION STUDY OF THE MTS AND 540 METAL BLADES

Review of the deflection curves on the next page indicates that:

1. **Above 60 RPM the MTS blade and the metal 540 blade have practically the same deflection.**

2. **Below 60 RPM the MTS blade has gradually increasing deflection (up to 20% at zero RPM).**

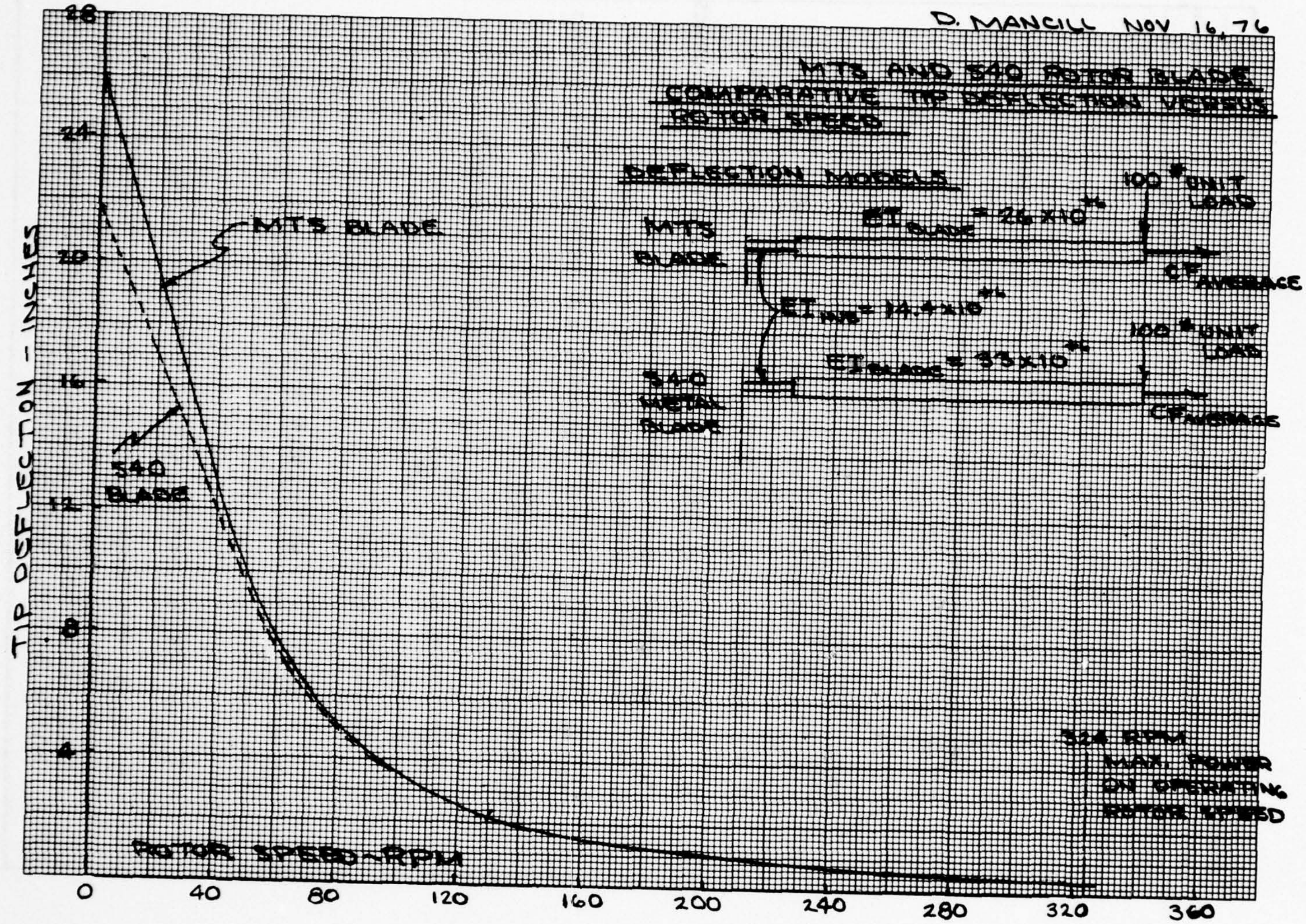
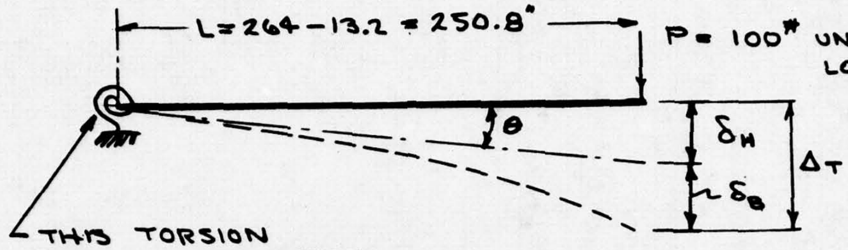


Figure B-11. MTS and 540 rotor blade comparative tip deflection versus rotor speed.

REPORT TITLE | REPORT NO. 150-S-1001
PREPARED BY D. MANCILL NOV 12, 76 | SUBJECT: MTS BLADE | MODEL NO.
CHECKED BY

DEFLECTION STUDY
WITHOUT CENTRIFUGAL FORCE



THIS TORSION SPRING REPRESENTS THE SOFT FLEXURE OF THE HUB YOKE {LENGTH = 13.2"}

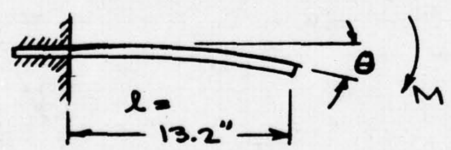
θ = DEFLECTION OF THE HUB YOKE ~ RADIANS.

δ_H = BLADE TIP DEFLECTION DUE TO HUB DEF. − INCHES

δ_B = BLADE TIP DEFLECTION DUE TO BLADE BENDING ~ INCHES

$\Delta_T = \delta_H + \delta_B$ TOTAL BLADE TIP DEFLECTION ~ INCHES

DETERMINATION OF θ



$EI = 14.4 \times 10^{+6}$

$$\theta = \frac{M\ell}{EI} = \frac{100 \times 250.8 \times 13.2}{14.4 \times 10^{+6}} = .02299 \text{ RADIANS}$$

$$\delta_H = \theta L = .02299 \times 250.8 = 5.766 \text{ IN.}$$

BLADE TIP DEFLECTION DUE TO HUB DEFLECTION WITH A UNIT 100# AT THE TIP. USE WITH BOTH MODEL 540 BLADE AND MTS BLADE DEFLECTIONS.

REPORT TITLE ______ REPORT NO. 150-S-1001

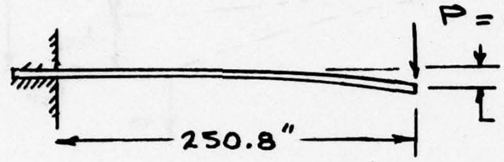
PREPARED BY D. MANCILL NOV 12, 76 SUBJECT MODEL NO. ______

CHECKED BY ______ MTS BLADE

DEFLECTION STUDY (WITHOUT C.F.)

FOR THIS COMPARATIVE DEFLECTION STUDY, THE FLAPWISE BENDING STIFFNESS IS ASSUMED TO BE CONSTANT ALONG THE BLADE.

THE STRUCTURAL BLADE DEFLECTION:



$$\delta_B = \frac{PL^3}{3EI}$$ THE EI OF THE CONSTANT BLADE SECTION WILL BE USED.

FOR THE S40 METAL BLADE

$$EI_{S40} \cong 33.0 \times 10^{+6}$$

THE "MTS" BLADE

$$EI_{MTS} = 26.0 \times 10^{+6}$$

$$\text{OR } \frac{EI_{S40}}{EI_{MTS}} = \frac{33}{26} = 1.27 \text{ STIFFNESS RATIO}$$

$$\delta_{B_{S40}} = \frac{100(250.8)^3}{3 \times 33 \times 10^{+6}} = 15.935 \text{ INCHES}$$

$$\delta_{B_{MTS}} = \frac{100(250.8)^3}{3 \times 26 \times 10^{+6}} = 20.225 \text{ INCHES}$$

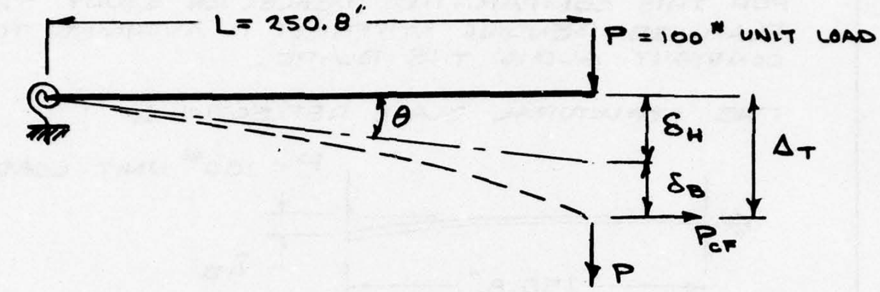
THE TOTAL DEFLECTION

$$\Delta_{T_{S40}} = \delta_H + \delta_{B_{S40}} = 5.766 + 15.935 = \underline{21.701''}$$

$$\Delta_{T_{MTS}} = \delta_H + \delta_{B_{MTS}} = 5.766 + 20.225 = \underline{25.991''}$$

REPORT TITLE		REPORT NO.	150-S-1001
PREPARED BY	D. MANCILL NOV 12, 76	SUBJECT	MODEL NO.
CHECKED BY		MTS BLADE	

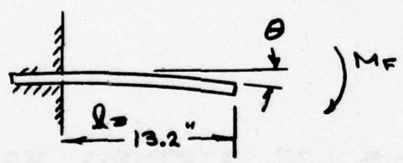
DEFLECTION STUDY (WITH CENTRIFUGAL FORCE)



CENTRIFUGAL FORCE WILL STIFFEN THE BLADE, THUS REDUCING THE DEFLECTIONS.

MOMENT AT THE HUB FLEXURE = M_F

$$M_F = PL - P_{CF}\Delta_T$$



BENDING STIFFNESS OF HUB = EI_H

$$\theta = \frac{M_F l}{EI_H} = \frac{l}{EI_H}\left\{PL - P_{CF}\Delta_T\right\} \text{ ------(a)}$$

$$\delta_H = L\theta = \frac{Ll}{EI_H}\left\{PL - P_{CF}\Delta_T\right\} \text{ ------(b)}$$

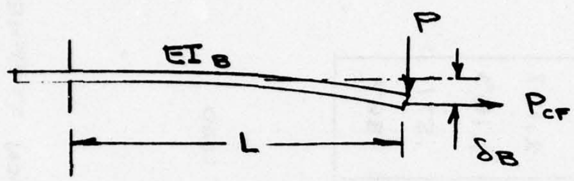
REPORT TITLE ____ REPORT NO. 150-3-1001

PREPARED BY D. MANCILL NOV 12, 76 SUBJECT MODEL NO.

CHECKED BY ____ MTS BLADE

DEFLECTION STUDY (WITH CENTRIFUGAL FORCE)

BLADE DEFLECTION



FROM ROARK FOURTH EDITION, PG 151, CASE 13 ~~REF~~ 6

$$\delta_B = \frac{P}{P_{CF}}\left(L - j \tanh U\right) \qquad \text{WHERE } j = \sqrt{\frac{EI_B}{P_{CF}}}$$

$$U = \frac{L}{j}$$

$$\Delta_T = \delta_H + \delta_B = \theta L + \delta_B$$

$$\therefore \theta = \frac{1}{L}\left(\Delta_T - \delta_B\right) \text{ ------ (c)}$$

EQUATING EQUATIONS (a) AND (c)

$$\frac{\ell}{EI_H}\left\{PL - P_{CF}\,\Delta_T\right\} = \frac{1}{L}\left(\Delta_T - \delta_B\right)$$

SOLVING FOR Δ_T

$$\boxed{\Delta_T = \frac{EI_H}{EI_H + P_{CF}\,\ell L}\left[\frac{\ell P L^2}{EI_H} + \delta_B\right]} \text{ -------- (d)}$$

WITHOUT CENTRIFUGAL FORCE

$$\Delta_T = \frac{\ell P L^2}{EI_H} + \frac{P L^3}{3 EI_B}$$

6 Roark, FORMULAS FOR STRESS AND STRAIN, Fourth Edition, McGraw-Hill Book Company, 1963.

REPORT TITLE

PREPARED BY D. MANCILL NOV 15, 76

CHECKED BY

SUBJECT MTS BLADE

REPORT NO. 150-S-1001

MODEL NO.

DEFLECTION STUDY (MTS BLADE)

1	2	3	4	5	6	7	8	9	10
% OF 324 RPM	RPM	P_{CF}	$\frac{EI_H}{EI_H + P_{CF}\ell L}$	γ	υ	TANH υ	δ_B	5.766 + ⑧	Δ_T
0	0	0	1.0	—	—	—	20.225	25.991	25.991
10	32.4	680	.8648	195.54	1.2826	.8572	12.233	17.999	15.566
20	64.8	2720	.6153	97.77	2.5652	.9882	5.669	11.435	7.036
40	129.6	10880	.2856	48.88	5.1309	.99993	1.856	7.622	2.177
60	194.4	24480	.1777	32.59	7.6956	1.0000	.891	6.657	1.183
80	259.2	43520	.0909	24.44	10.262	1.0000	.520	6.286	.571
100	324	68000	.0601	19.55	12.829	1.0000	.340	6.106	.367

CONSTANTS

$L = 264 - 13.2 = 250.8$ IN ; $\ell = 13.2$ IN ; $P = 100^{\#}$ UNIT LOAD

HUB STIFFNESS $= EI_H = 14.4 \times 10^{+6}$

$$\frac{\ell L^2 P}{EI_H} = \frac{13.2(250.8)^2(100)}{14.4 \times 10^{+6}} = 5.766 \text{ IN}$$

$EI_B = 26.0 \times 10^{+6}$ (MTS BLADE) THE CONSTANT BLADE SECTION STIFFNESS

$$\Delta_T = \frac{EI_H}{EI_H + P_{CF}\ell L}\left[\frac{\ell P L^2}{EI_H} + \delta_B\right] = ④⑨ \text{ ; WHERE } \delta_B = \frac{100}{③}(250.8 - ⑤⑦)$$

AD-A046 176 HUGHES HELICOPTERS CULVER CITY CALIF F/G 1/3
FLIGHT TEST OF A COMPOSITE MULTI-TUBULAR SPAR MAIN ROTOR BLADE --ETC(U)
AUG 77 R E HEAD DAAJ02-74-C-0055
UNCLASSIFIED HH-76-281-VOL-1 USAAMRDL-TR-77-19A NL

3 OF 4
ADA046176

REPORT TITLE

PREPARED BY D. MANCILL NOV 16, 76

CHECKED BY

SUBJECT MTS BLADE

REPORT NO. 150-S-1001

MODEL NO.

DEFLECTION STUDY (540 BLADE)

① % OF 324 RPM	② RPM	③ P_{CF}	④ $\frac{EI_H}{EI_H + P_{CF} L}$	⑤ γ	⑥ U	⑦ TANH U	⑧ δ_B	⑨ 5.766 + ⑧	⑩ Δ_T
0	0	0	1.0	—	—	—	15.935	21.701	21.701
10	32.4	680	.8648	220.3	1.1384	.8139	10.514	16.28	14.079
20	64.8	2720	.6153	110.1	2.2779	.9792	5.257	11.023	6.782
40	129.6	10880	.2856	55.07	4.5542	.9998	1.799	7.565	2.161
60	194.4	24480	.1777	36.72	6.830	1.0000	.874	6.640	1.180
80	259.2	43520	.0909	27.54	9.1068	1.0000	.513	6.279	.571
100	324	68000	.0601	22.03	11.384	1.0000	.336	6.102	.367

$EI_B \doteq 33 \times 10^{+6}$

COMPUTER PROGRAM DATA – BOX PROGRAM

This program determines the internal shear flow distribution and torsional stiffness of a multi-cell torque box.

```
RUN

BOX    12:36   04/22/75

THIS PROGRAM DETERMINES THE INTERNAL SHEAR FLOW DISTRIBUTION AND
TORSIONAL STIFFNESS OF A MULTI-CELL TORQUE BOX
INPUT NUMBER OF CELLS IN THE SECTION
?6
INPUT CELL AREAS AND SUM (L/T) FOR CELLS FROM LEFT TO RIGHT
NOTE: CELLS MUST BE NUMBERED FROM LEFT TO RIGHT
?2.763,133.248
?5.56,292.690
?4.73,345.301
?4.58,348.587
?4.33,3522+.171
?11.96,7211.141
INPUT (L/T) FOR COMMON CELL WALLS STARTING FROM WEB 1-2
?44.66
?122.872
?119.681
?120.238
?107.097

PROBLEM HAS GONE THRU 20 OR MORE ITERATIONS

LAST ITERATION NOT WITHIN 1% OF TOTAL SHEAR FLOW
DO YOU WISH TO CONTINUE (5) MORE ITERATIONS ? (YES OR NO)
?YES
                                                     Ge = 10
SHEAR FLOW DISTRIBUTION FOR GO = 1

CELL            1            SHEAR FLOW      .069107
CELL            2            SHEAR FLOW      8.26259E-2
CELL            3            SHEAR FLOW      8.14319E-2
CELL            4            SHEAR FLOW      7.14323E-2
CELL            5            SHEAR FLOW      5.01506E-2
CELL            6            SHEAR FLOW      4.06043E-3

TOTAL TORQUE    3.25678  ->  GJ = 32.57

CELL STIFFNESS EQUALS  .307052 T/G RADIANS/UNIT LENGTH OF CELL

DO YOU WISH TO OBTAIN THE SHEAR FLOW DISTRIBUTION FOR A
GIVEN TORQUE ? (YES OR NO)
?YES

ENTER APPLIED TORQUE
?10000

CELL            1            SHEAR FLOW      212.194
CELL            2            SHEAR FLOW      253.704
CELL            3            SHEAR FLOW      250.038
CELL            4            SHEAR FLOW      219.334
CELL            5            SHEAR FLOW      153.986
CELL            6            SHEAR FLOW      12.4676

APPLIED TORQUE  10000
NOW AT 890
SRU'S:0.6
READY
OFF

USAGE ON 04/22/75 AT 12:39:58                              G.F. Acker
SRU'S:1.1  ELAPSED TIME: 00:03:40
```

APPENDIX C

DYNAMIC TEST DATA

The data from the input load frequency sweeps are plotted here for MTS flight blades, S/N-006 and -007, mounted on a 540 hub (NSN 1615-00-918-9357). This is followed by data from a pair of 540 blades (NSN 1516-00-178-9680) mounted on the same hub.

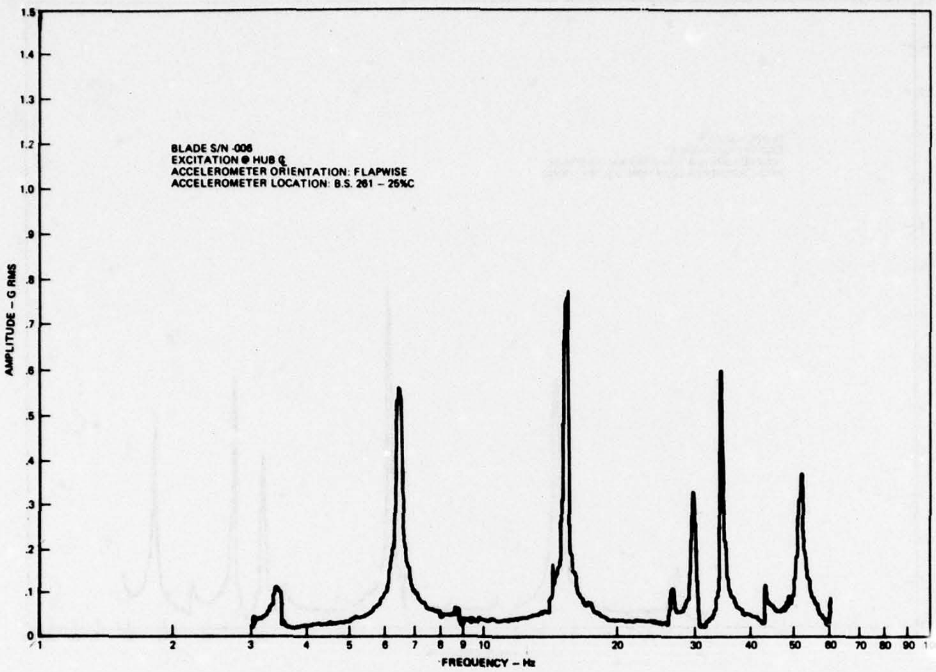


Figure C-1. MTS main rotor assembly dynamic response test.

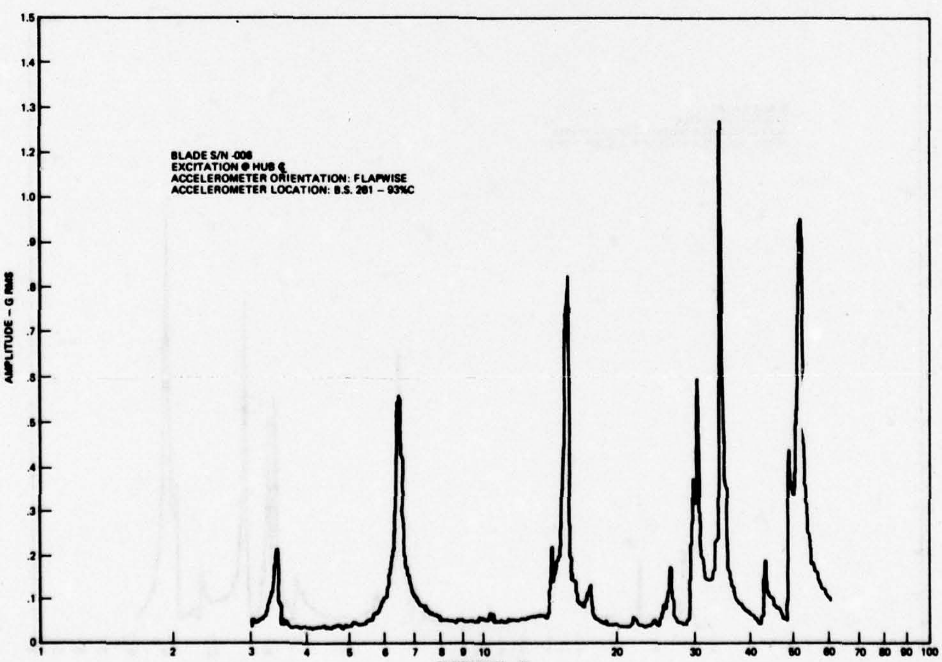


Figure C-2. MTS main rotor assembly dynamic response test.

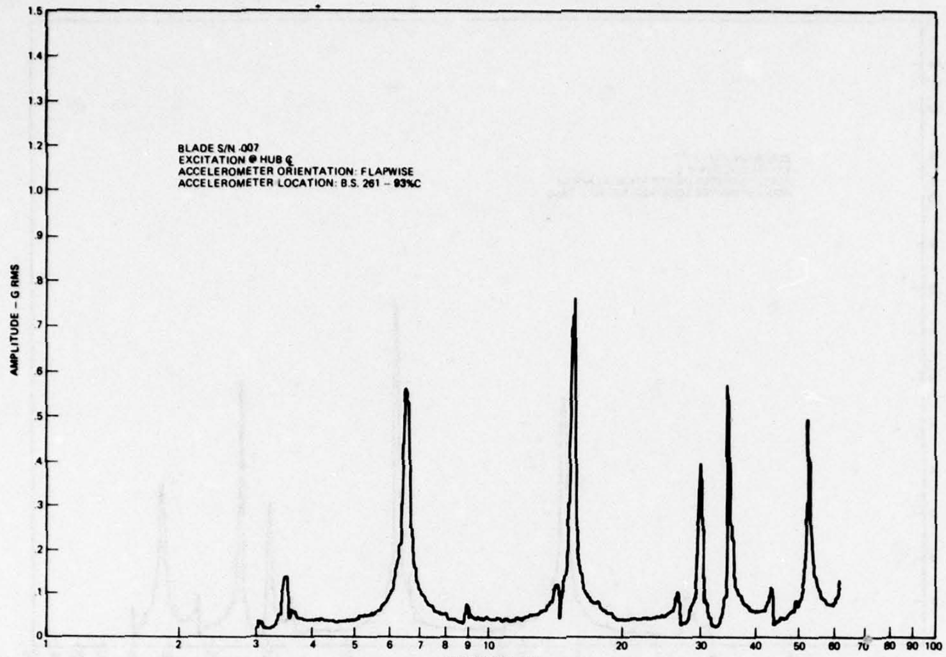


Figure C-3. MTS main rotor assembly dynamic response test.

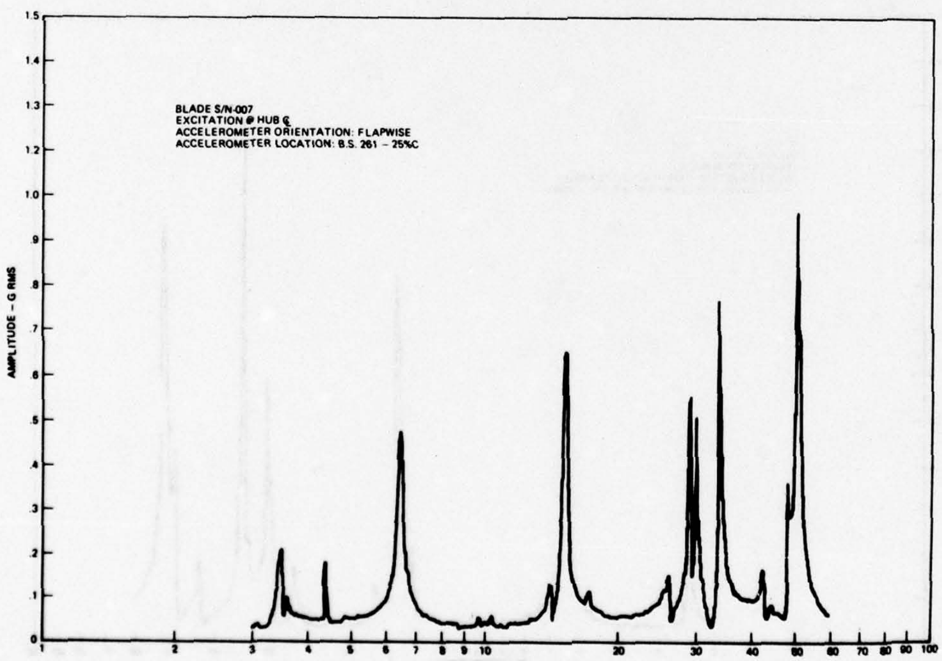


Figure C-4. MTS main rotor assembly dynamic response test.

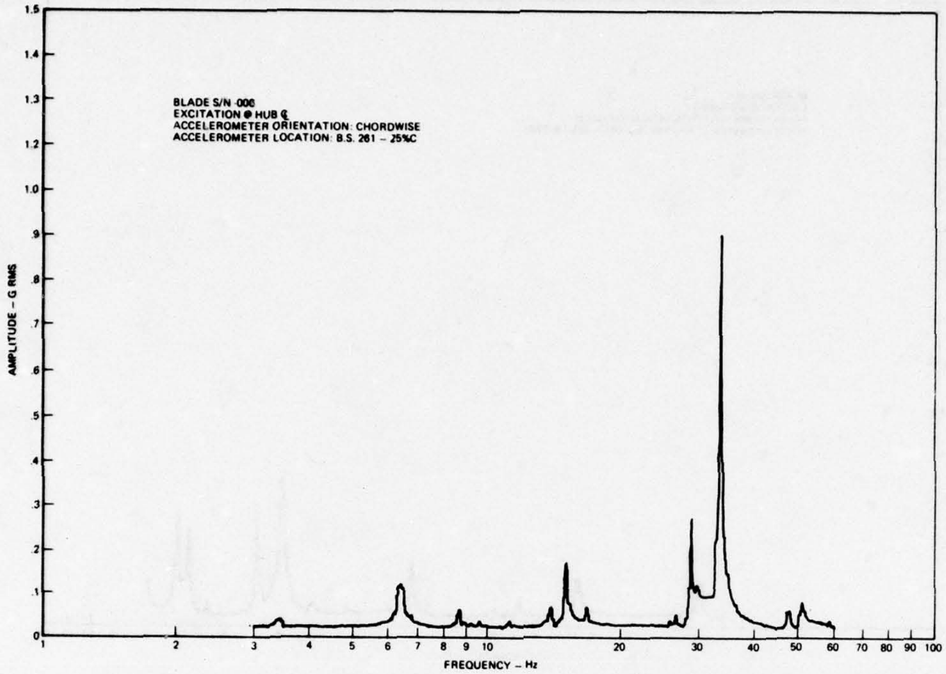


Figure C-5. MTS main rotor assembly dynamic response test.

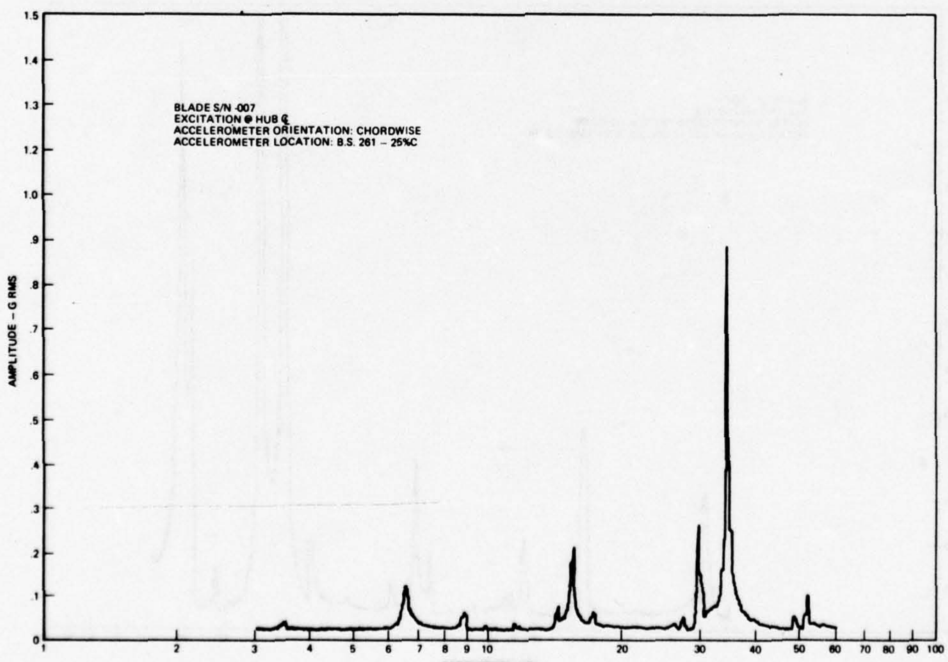


Figure C-6. MTS main rotor assembly dynamic response test.

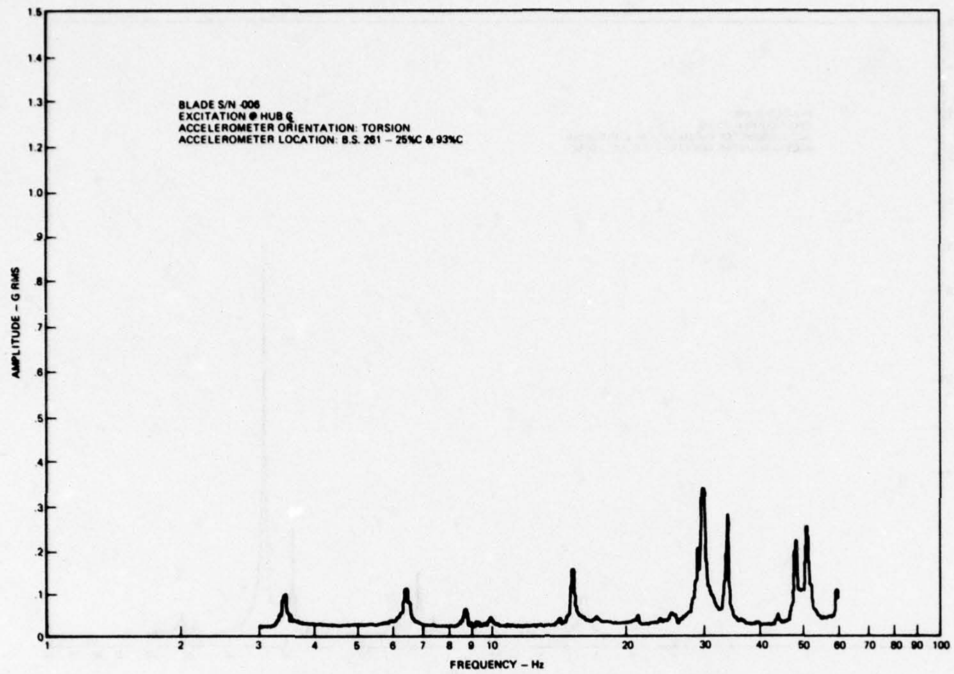


Figure C-7. MTS main rotor assembly dynamic response test.

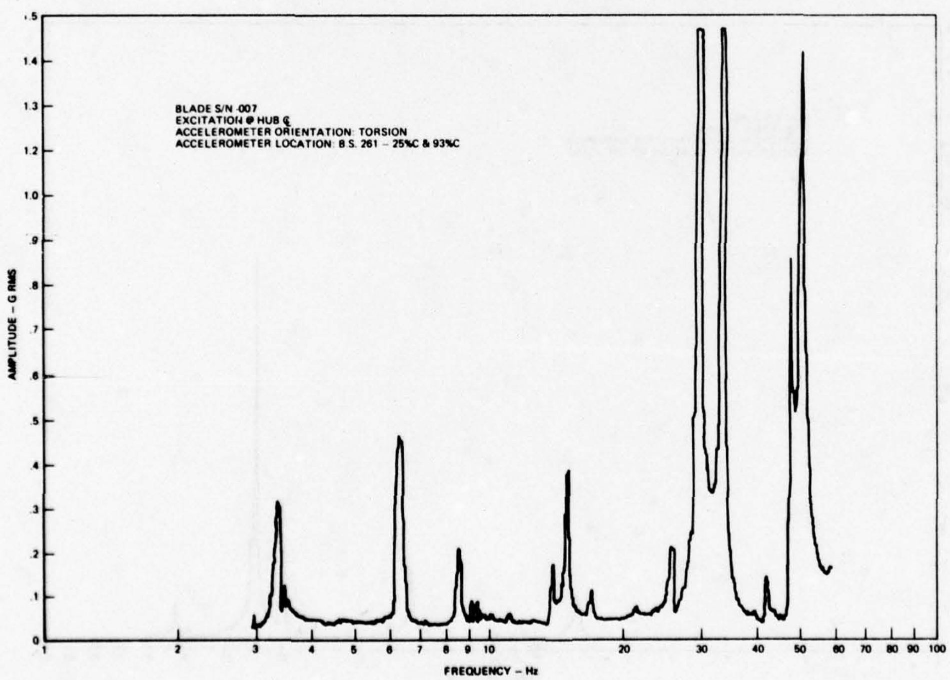


Figure C-8. MTS main rotor assembly dynamic response test.

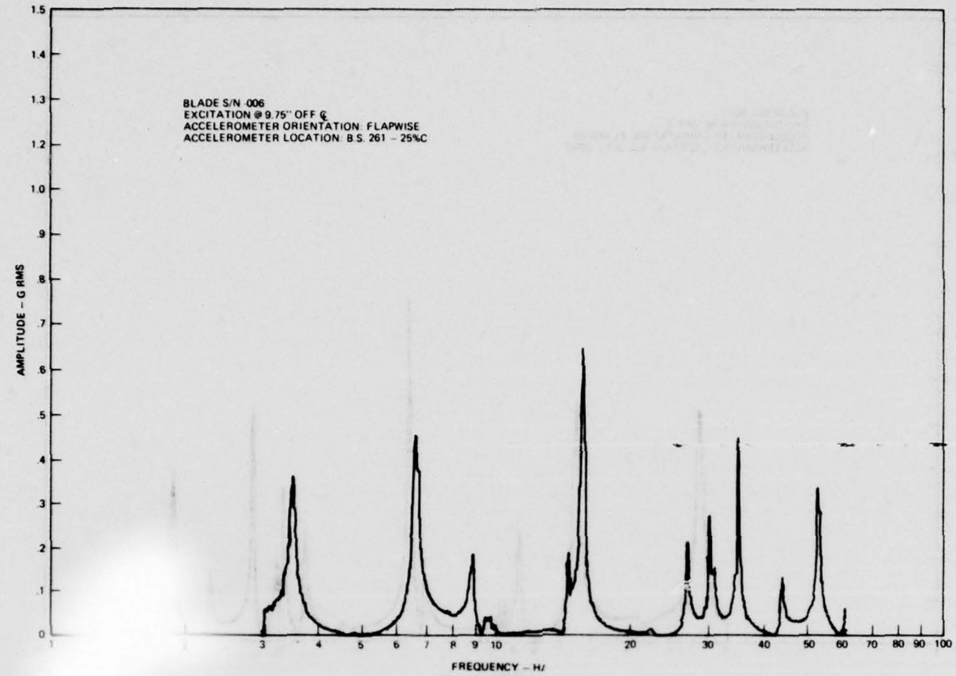


Figure C-9. MTS main rotor assembly dynamic response test.

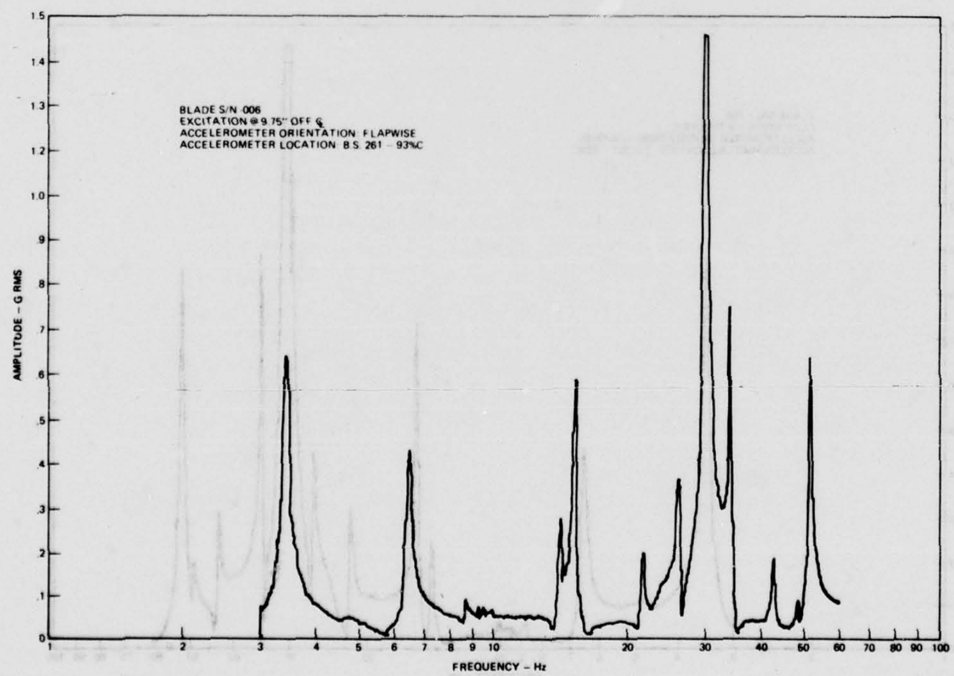


Figure C-10. MTS main rotor assembly dynamic response test.

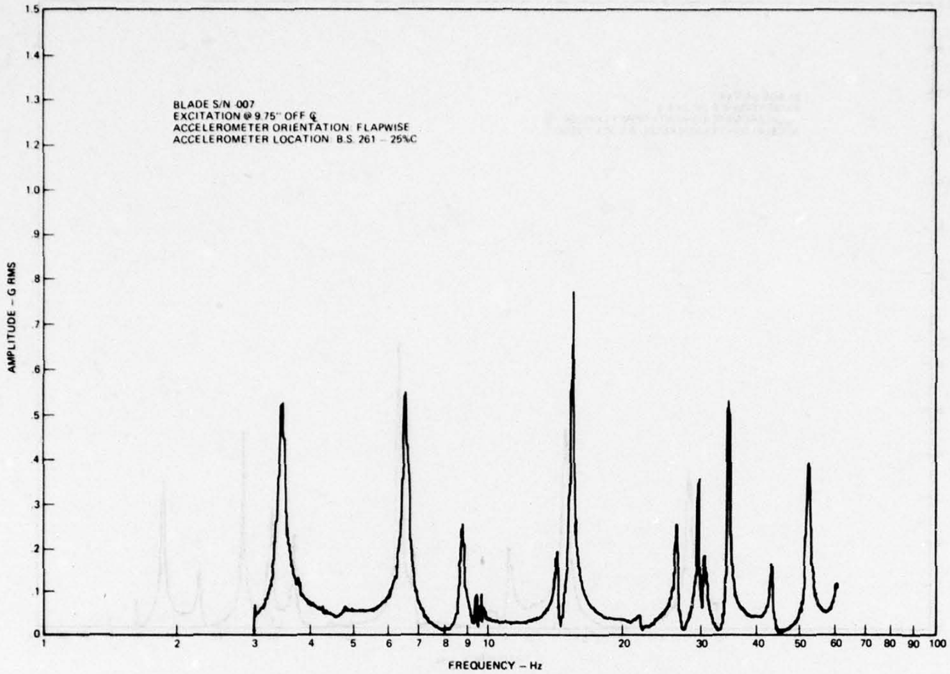


Figure C-11. MTS main rotor assembly dynamic response test.

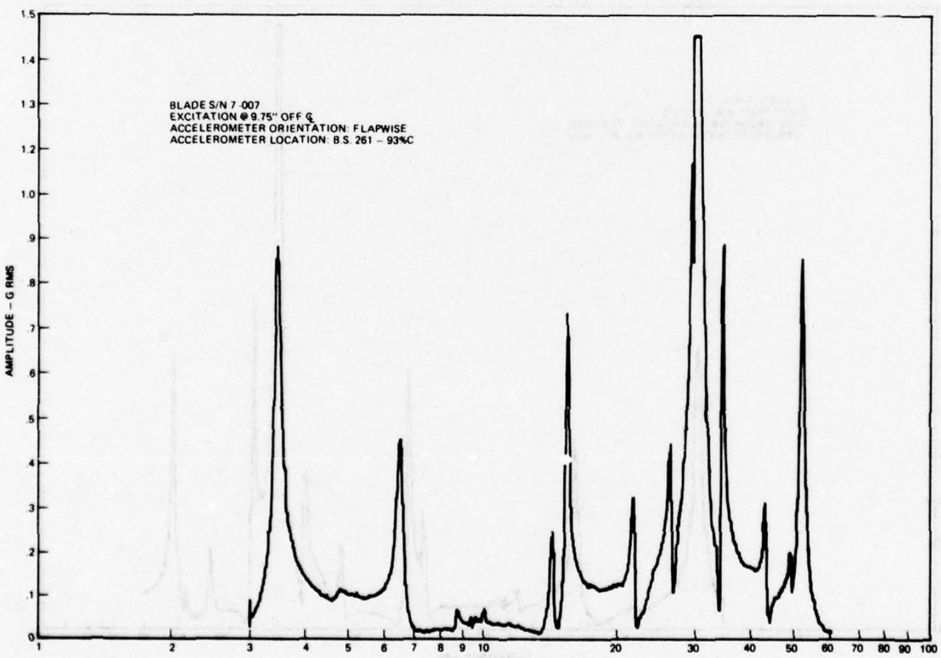


Figure C-12. MTS main rotor assembly dynamic response test.

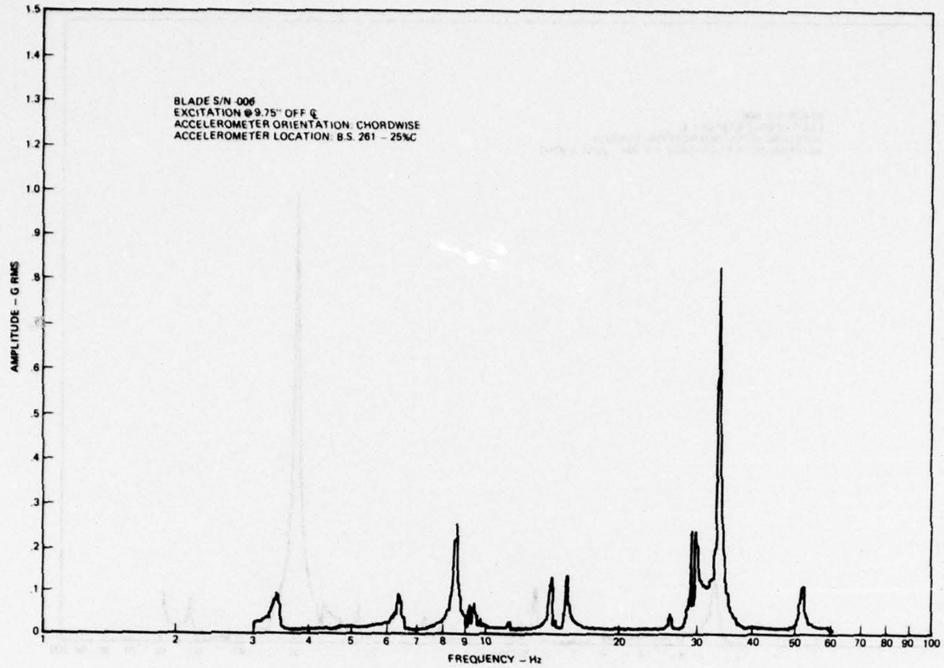


Figure C-13. MTS main rotor assembly dynamic response test.

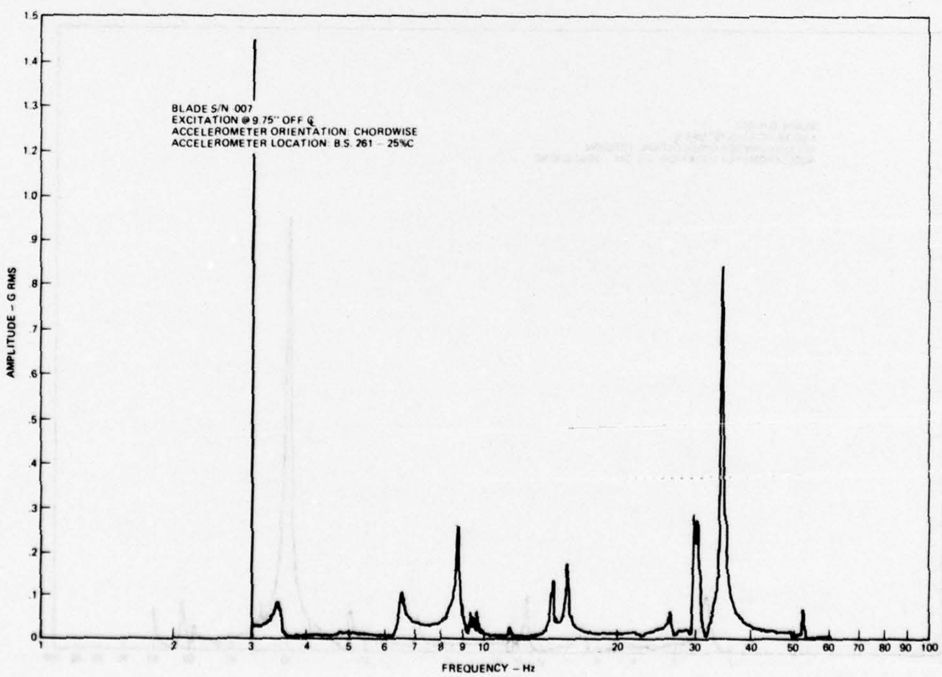


Figure C-14. MTS main rotor assembly dynamic response test.

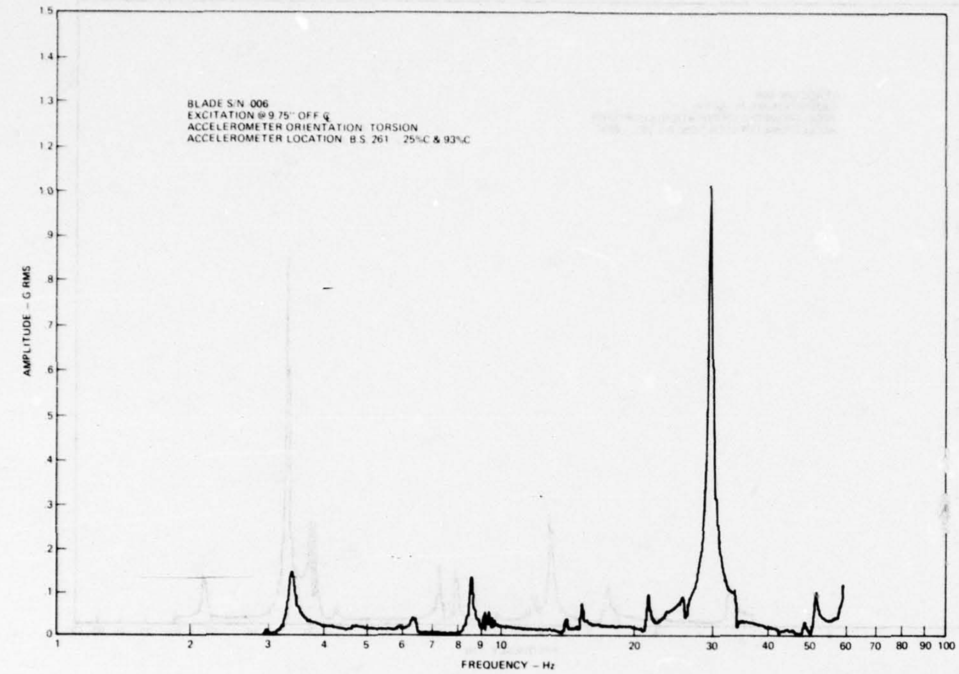


Figure C-15. MTS main rotor assembly dynamic response test.

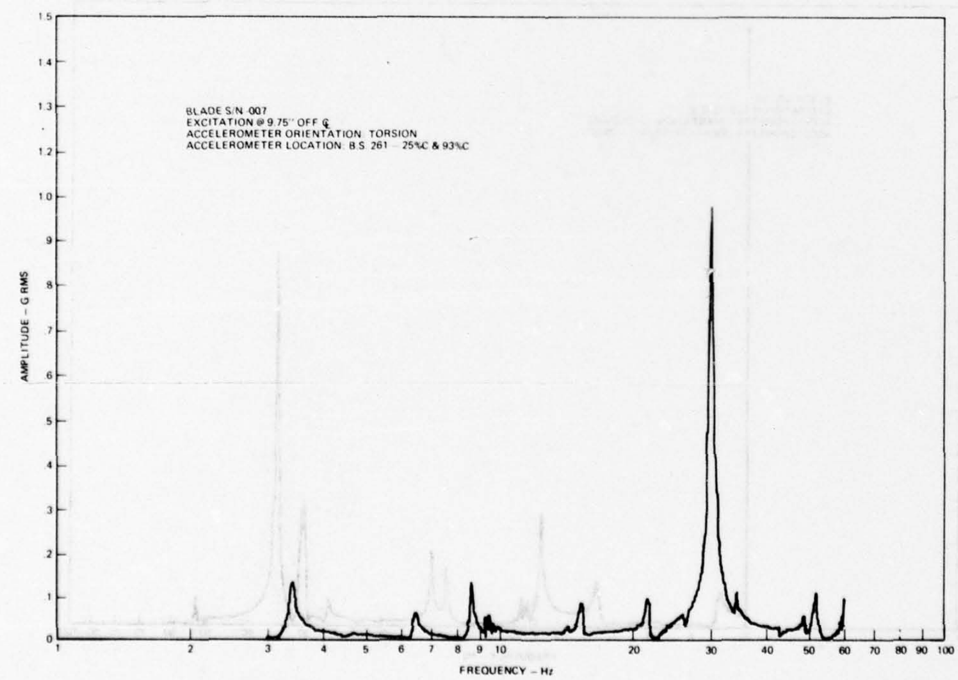


Figure C-16. MTS main rotor assembly dynamic response test.

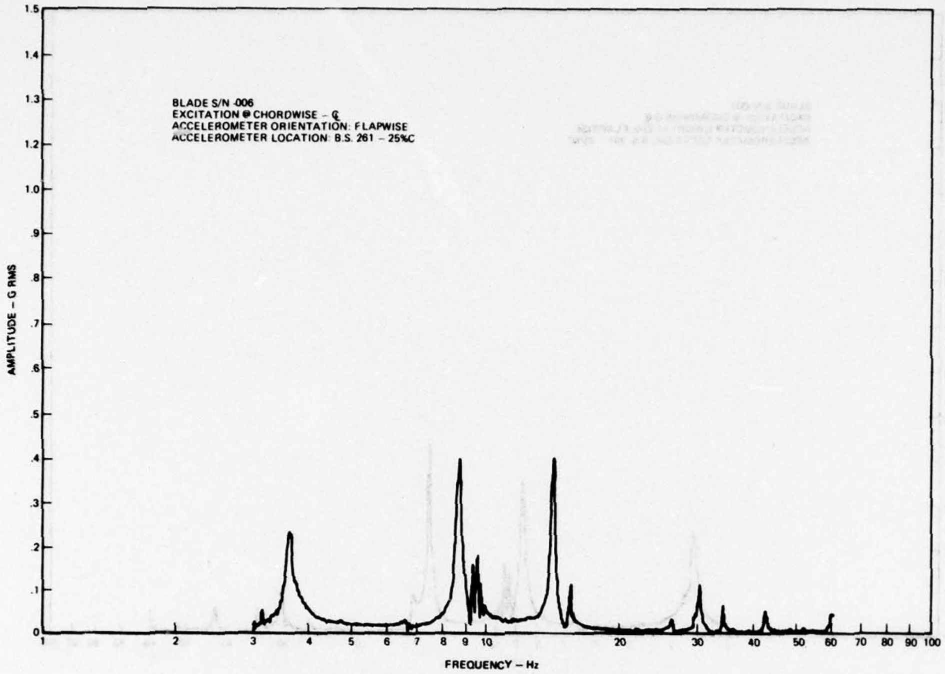


Figure C-17. MTS main rotor assembly dynamic response test.

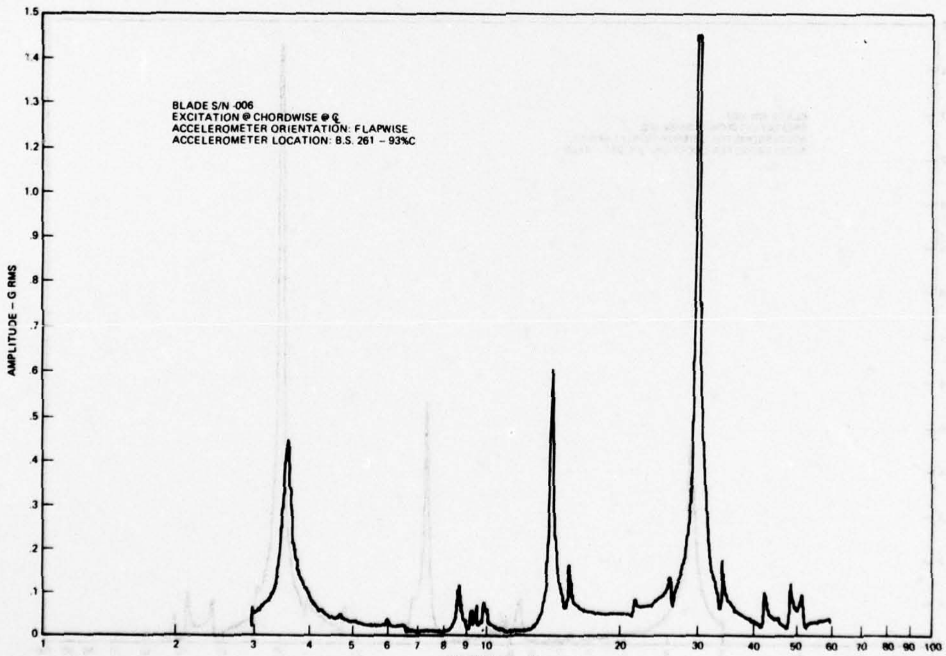


Figure C-18. MTS main rotor assembly dynamic response test.

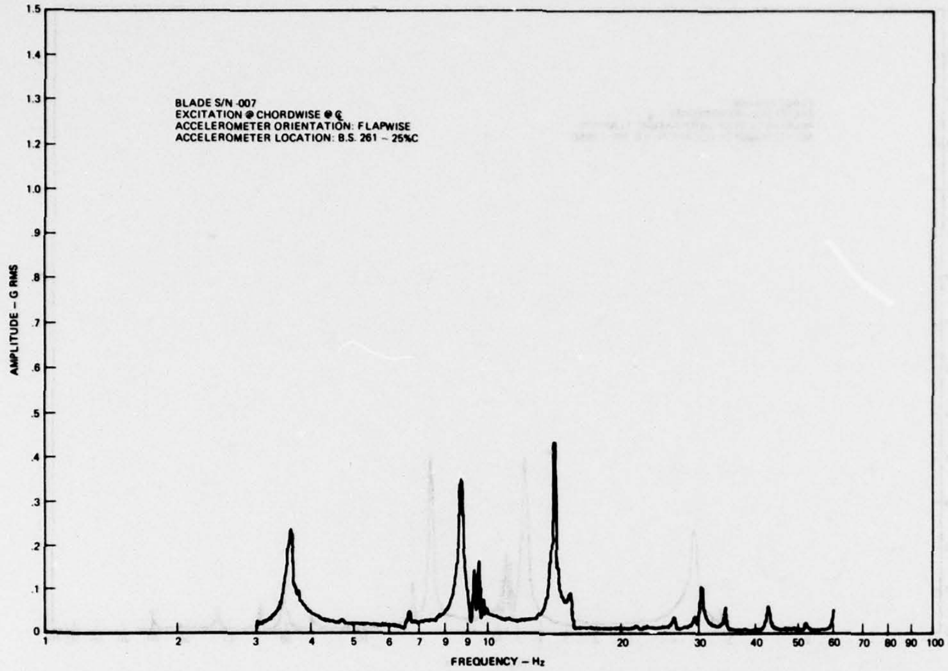


Figure C-19. MTS main rotor assembly dynamic response test.

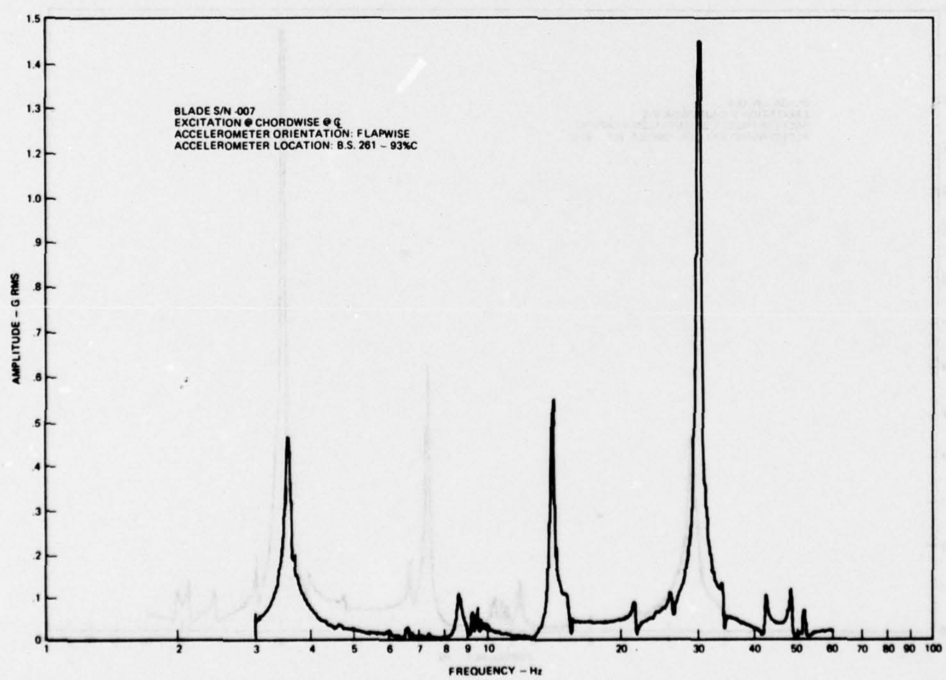


Figure C-20. MTS main rotor assembly dynamic response test.

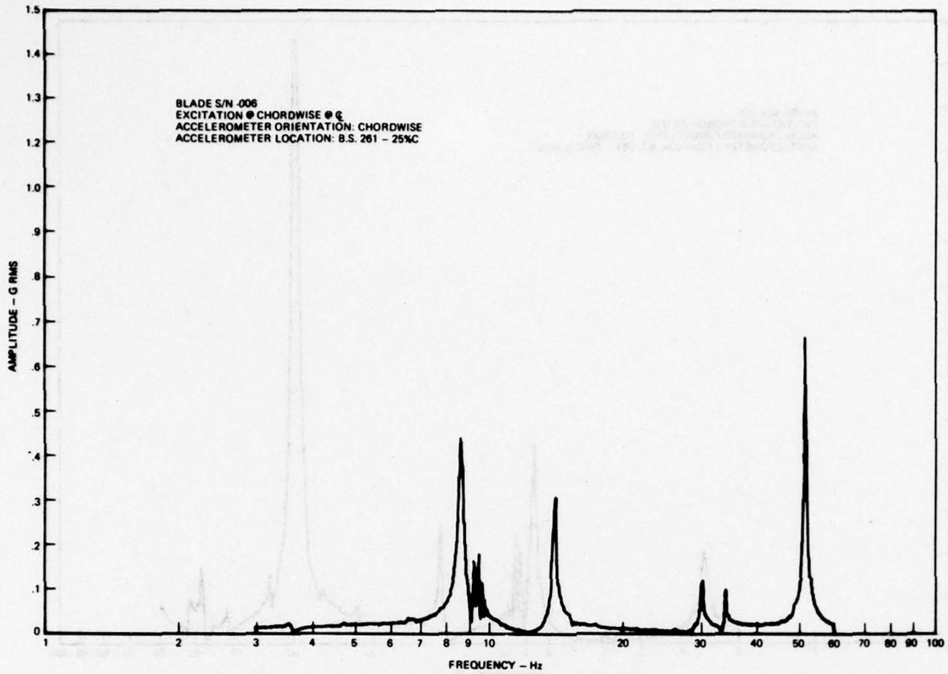


Figure C-21. MTS main rotor assembly dynamic response test.

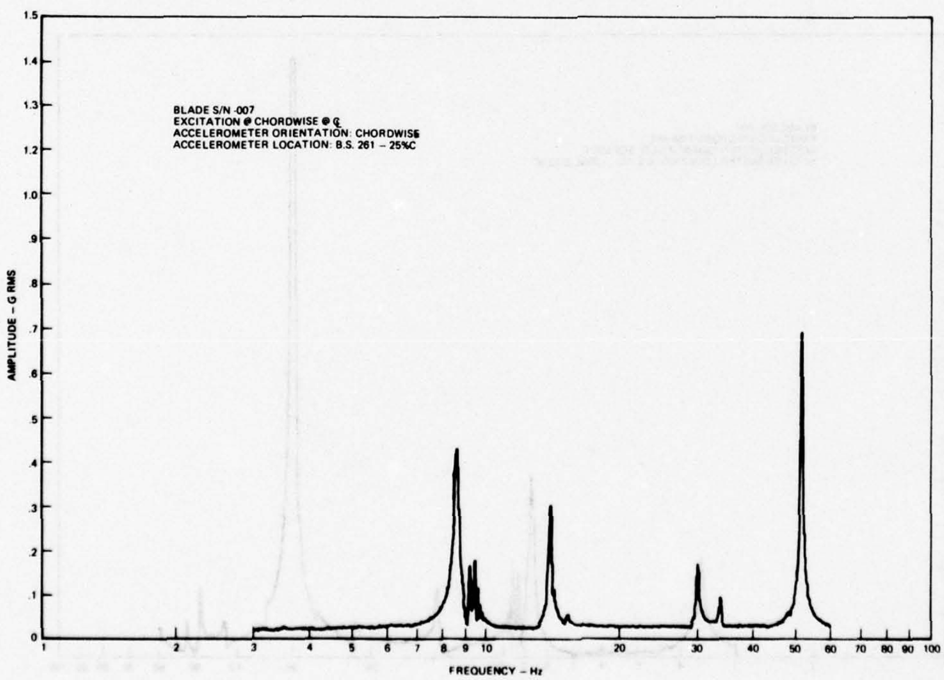


Figure C-22. MTS main rotor assembly dynamic response test.

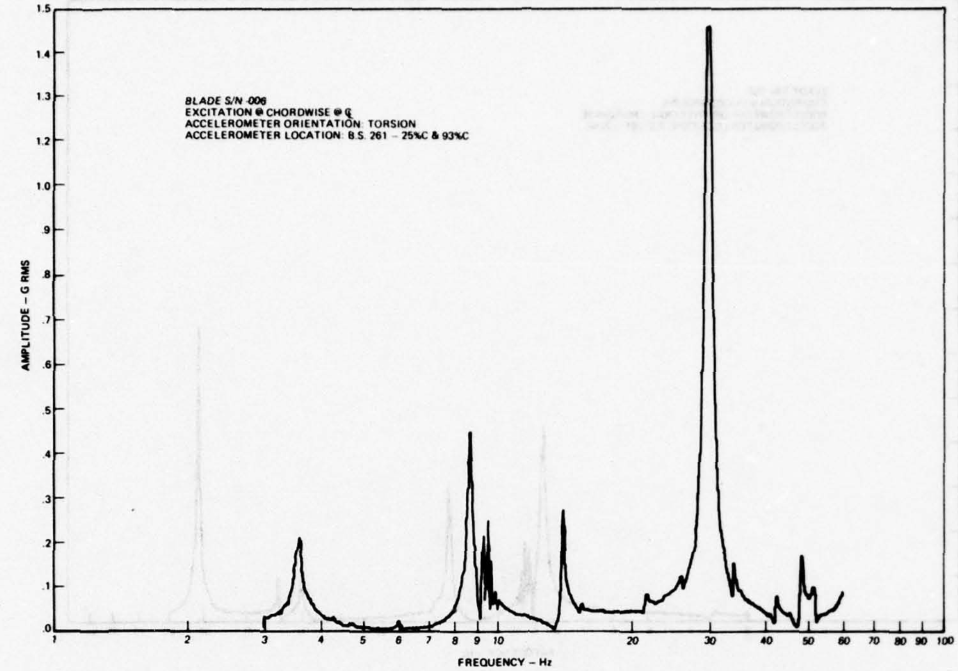


Figure C-23. MTS main rotor assembly dynamic response test.

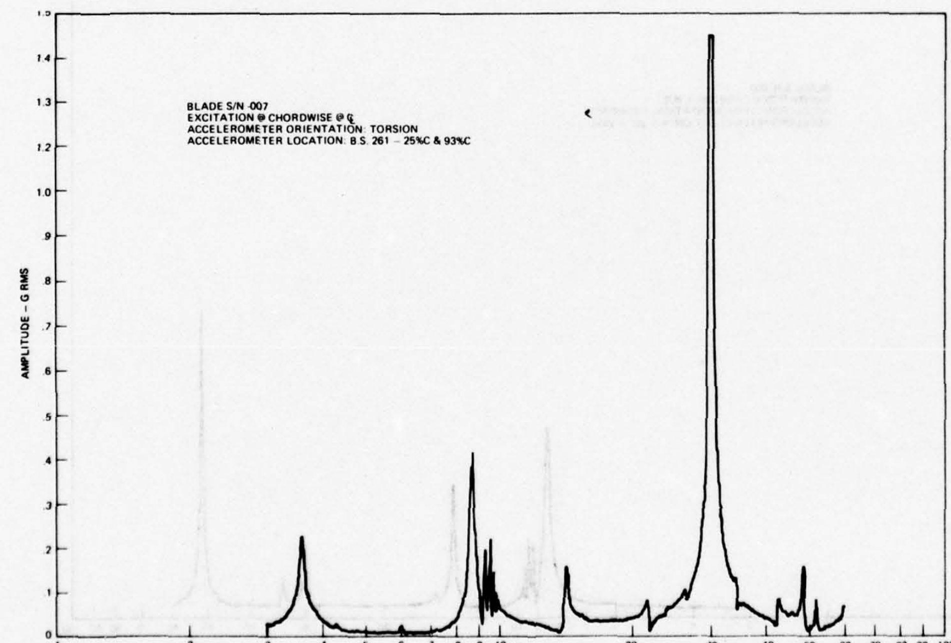


Figure C-24. MTS main rotor assembly dynamic response test.

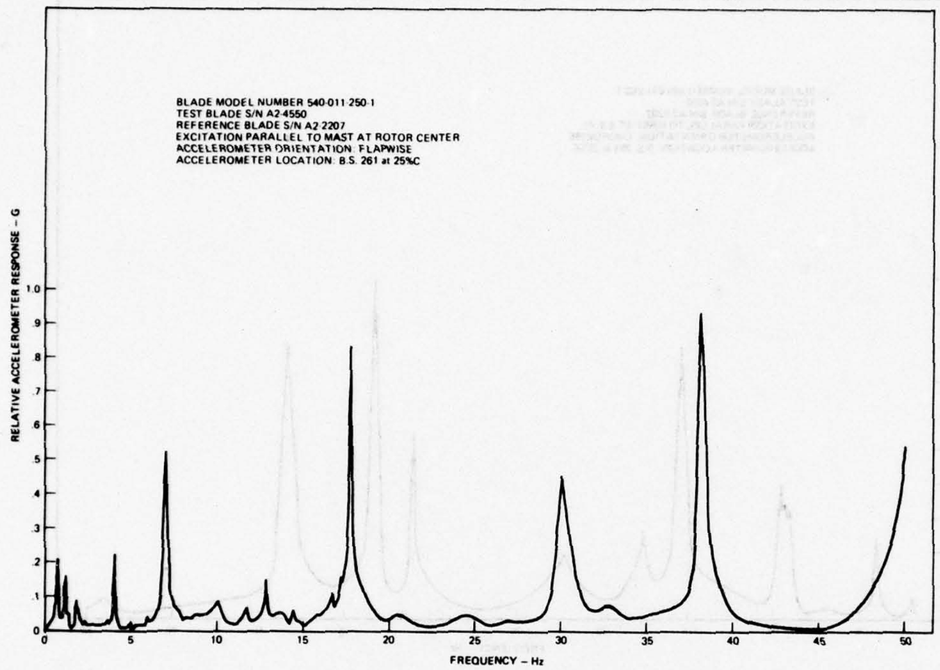


Figure C-25. 540 main rotor assembly dynamic response test.

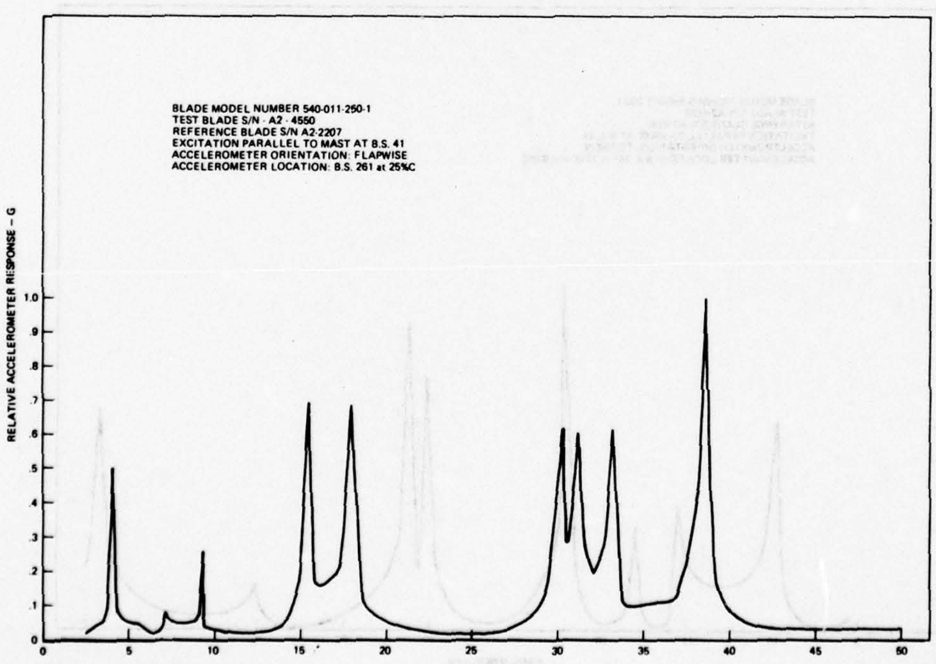


Figure C-26. 540 main rotor assembly dynamic response test.

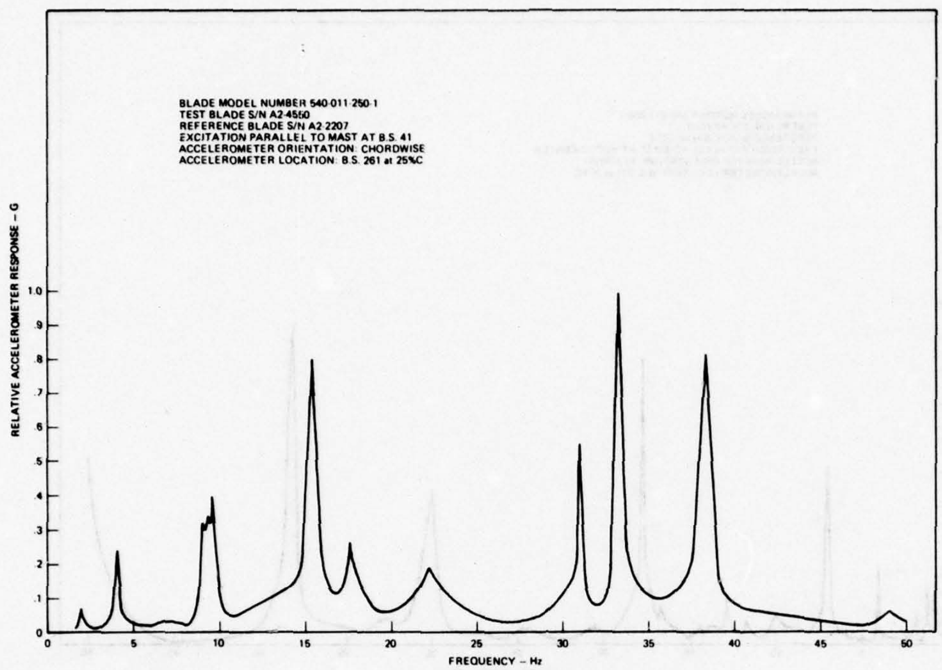


Figure C-27. 540 main rotor assembly dynamic response test.

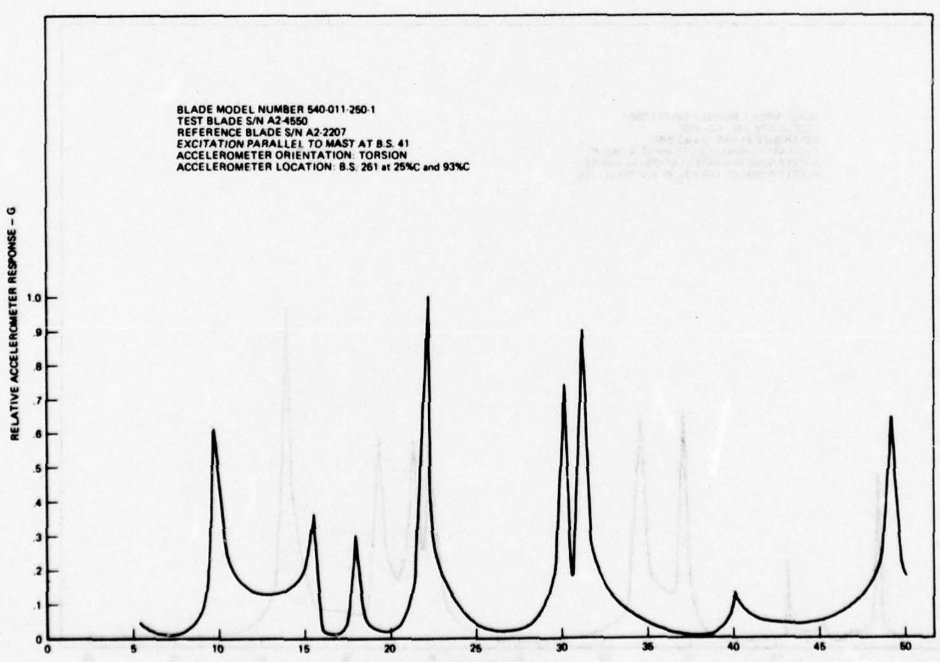


Figure C-28. 540 main rotor assembly dynamic response test.

APPENDIX D

SUPPLEMENTARY GROUND TEST DATA

TABLE D-1. GROUND TEST SCHEDULE

Run Number	RPM	Collective Pitch (percent)	Cyclic Pitch Pulse: Forward Longitudinal (percent)	Cyclic Pitch Pulse: Right Lateral (percent)	Time (minutes)
1	230	10	10 (1 second)#	10 (1 second)#	15
	280				
	290				
	294				
	300				
	305				
	310				
	315				
	320				
	324				
2	Run 1 RPM Schedule	0	10 (1 second)	10 (1 second)#	21
3	294	0	10 (10 second)	10 (10 second)	17
	300				
	305				
	310				
	315				
	320				
	324				
4	Run 3 RPM Schedule	20	10 (10 second)	10 (10 second)	18
5	Run 3 RPM Schedule	40*	10 (10 second)	10 (10 second)	25
6	Run 3 RPM Schedule	0	20 (10 second)	20 (10 second)	19
	324	40	10 (10 second)	10 (10 second)	
7	Run 3 RPM Schedule	40	10 (10 second)	10 (10 second)	23
8	Run 3 RPM Schedule	20	20 (10 second)	20 (10 second)	24
9	Run 3 RPM Schedule	40	20 (10 second)	20 (10 second)	28
	324	20	20 (10 second)	20 (10 second)	

Beginning with Run Number 10, all runs were made at 324 rpm. Each run was broken into three segments:

- 20 percent** of the run: collective pitch was held at 40 percent while 10 percent forward and 10 percent right cyclic pitch inputs were made for 10 seconds each. The cyclic inputs were made at 0 percent, 10 percent, and 20 percent time intervals. **
- 40 percent** of the run: collective pitch was held at 40 percent while 20 percent forward and right cyclic pitch inputs were made for 10 seconds each. The cyclic inputs were made at the 30, 40, 50, and 60 percent time intervals. **
- 20 percent** of the run: longitudinal and lateral cyclic pitch was held in neutral. Collective pitch was held at the 10, 0, 20, 30, 40, and 10 percent levels, each for 6 percent** of the run time.

	Run Number	Time** (minutes)
	10	66
	11	66
	12	20
	13	20
	14	22
	15	19
	16	36
	17	34
	18	66
	19	66
Total		605 minutes = 10.08 hours

#Denotes length of time the cyclic control was held away from neutral.

*Corresponds to maximum allowable engine torque.

**Percentage figures refer to 100 percent being the total time of the specific ground run.

APPENDIX E

SUPPLEMENTARY FLIGHT TEST DATA; MTS BLADES – FORWARD CG CONDITION

TABLE E-1. FLIGHT TEST SCHEDULE, BASIC MTS BLADE PROGRAM

Flight Number	Time (hours)	RPM	Airspeed (knots)	SCAS	Collective	Lateral	Pedal	Longitudinal	Input
1	0.6	324	0	OFF	0	53	50	35-65	Slow
				OFF	0	53	50	35-65	10 second step
				ON	0	53	50	35-65	10 second step
				OFF	0	53	50	35-65	Slow
				OFF	0	53	50	35-65	10 second step
				ON	0	53	50	35-65	10 second step
				ON	Hover - Feel Out				
				OFF	Hover - Feel Out				
				ON	Forward Cyclic Pulse 5%				
				OFF	Forward Cyclic Pulse 5%				
					Test Conditions				
2	0.3	324	0		Tail Rotor Track				
			0		Pedal Release				
			0		Lift Off to Hover				
			0		Stable Hover				
		0-324	0		RPM Sweep on Ground				
		324	0		Lift Off to Hover				
			0		Hover, Turn to Right, Mild				
			0		Hover, Turn to Left, Mild				
			0-10		Acceleration				
			10		Level Flight				
			10-0		Deceleration				
			0-20		Acceleration				
			20		Level Flight				
			20-0		Deceleration				
			0-10		Right Sideward Acceleration				
			10		Right Sideward Flight				
			10-0		Right Sideward Deceleration				
			0-10		Left Sideward Acceleration				
			10		Left Sideward Flight				
			10-0		Left Sideward Deceleration				
			0		Rearward Acceleration				
			10		Rearward Flight				
			10-0		Rearward Deceleration				
			0		Hover to Landing				
		324-0	0		Shutdown				
3	0.2	324	0		Lift Off to Hover				
			0		Stable Hover				
		0-324	0		RPM Sweep on Ground				
		324	0		Lift Off to Hover				
			0		Hover, Turn to Right, Mild				
			0		Hover, Turn to Left, Mild				
			0-10		Acceleration				
			10		Level Flight				
			10-0		Deceleration				
			0-20		Acceleration				
			20		Level Flight				
			20-0		Deceleration				

TABLE E-1 - Continued

Flight Number	Time (hours)	RPM	Airspeed (knots)	Test Conditions
4	0.3	324	0-10	Right Sideward Acceleration
			10	Right Sideward Flight
			10-0	Right Sideward Deceleration
			0-10	Left Sideward Acceleration
			10	Left Sideward Flight
			10-0	Left Sideward Deceleration
			0-10	Rearward Acceleration
			10	Rearward Flight
			10-0	Rearward Deceleration
			0	Hover to Landing
		324-0	0	Shutdown
5	0.5	324	0-30	Acceleration
			30	Level Flight
			30-0	Deceleration
			0-40	Acceleration
			40	Level Flight
			40-0	Deceleration
			0-50	Acceleration
			50	Level Flight
			50-0	Deceleration
			0-60	Acceleration
			60	Level Flight
			60-0	Deceleration
			0-10	Right Sideward Acceleration
			10	Right Sideward Flight
			10-0	Right Sideward Deceleration
			0-10	Left Sideward Acceleration
			10	Left Sideward Flight
			10-0	Left Sideward Deceleration
			0-10	Rearward Acceleration
			10	Rearward Flight
			10-0	Rearward Deceleration
			0	Hover to Landing
		324-0	0	Shutdown
6	0.5	324	0-70	Mild Acceleration
			70	Level Flight
			70-0	Mild Flare
			0-80	Mild Acceleration
			80	Level Flight
			80-0	Mild Flare
			0-40	Moderate Acceleration
			40	Level Flight
			40-0	Moderate Flare
			0-50	Moderate Acceleration
			50	Level Flight
			50-0	Moderate Flare
			0-60	Moderate Acceleration
			60	Level Flight
			60-0	Moderate Flare
			0	Hover Right Turn, 30°/sec
			0	Hover Left Turn, 30°/sec
			0-60-0	Accelerate, Climb at 500 fpm, Low Power Descent, Hover

TABLE E-1 - Continued

Flight Number	Time (hours)	RPM	Airspeed (knots)	Test Conditions
7	0.6	324	0-70-0	Accelerate, Climb at 500 fpm, Autorotation Descent, Flare
			70	Climb
			80	Level Flight
			85	Level Flight
			70	1.25g Left Turn
			70	1.25g Right Turn
		324-294-324	70	Autorotation RPM Sweep
		324	70	Power Recovery
8	0.8	324	70	Climb at 1000 fpm
			70	Level Flight
			85	Level Flight
			95	Level Flight
			105	Level Flight
			70	1.5g Left Turn
			70	1.5g Right Turn
			70	1.25g Pullup
			85	1.25g Left Turn
			85	1.25g Right Turn
			70	One Ball Left Sideslip
			70	One Ball Right Sideslip
			70	Autorotation Entry
			70	Autorotation, 30° Bank, Left Turn
			70	Autorotation, 30° Bank, Right Turn
			75	Autorotation
			85	Autorotation
			85	Power Recovery
			85-0	Approach to Hover and Flare
9	1.1	324	0-10-0	Mild Acceleration and Flare
			0-20-0	Mild Acceleration and Flare
			0-40-0	Mild Acceleration and Flare
			0-10-0	Mild Acceleration and Flare to Right
			0-10-0	Mild Acceleration and Flare to Left
			0-10-0	Mild Acceleration and Flare Rearward
			0-40-0	Moderate Acceleration and Flare
			0	Hover Turn to Right, 30°/second
			0	Hover Turn to Left, 30°/second
			0-40-0	Maximum Acceleration and Flare
			0-60-0	Acceleration, 60-kts Climb, Power Descent
			0-70	Acceleration and Climb at 70 kts at 500 fpm
			70	Autorotation
			70	Power Recovery
			70-0	Land
			0-70	Acceleration and Climb at 1000 fpm
			85	Level Flight
			85	Autorotation
			85	Power Recovery
			85-0	Land
10	0.4	324	0-85	Acceleration, Climb at 85 kts at 500 fpm
			70	1.25g Left Turn
			70	1.25g Right Turn
		324-294-324	70	Autorotation RPM Sweep
		324	70	Power Recovery
		324	70-0	Land

TABLE E-1 - Continued

Flight Number	Time (hours)	RPM	Airspeed (knots)	Test Conditions
11	1.8	324	0-85	Acceleration, Climb at 85 kts at 1000 fpm
			95	Level Flight
			105	Level Flight
			70	Autorotation, 30° Left Turn
			70	Autorotation, 30° Right Turn
			60	Autorotation
			60	Power Recovery
			60-0	Land
			70	Climb
			70	1.5g Left Turn
			70	1.5g Right Turn
			70	1.25g Pullup
			70-0	Land
			70	Climb
			85	1.25g Left Turn
			85	1.25g Right Turn
			70	1/2-Ball Right Sideslip
			70	1/2-Ball Left Sideslip
			85	Autorotation
			85	Power Recovery
			85-0	Land
12	0.8	324	0-70	Acceleration, Climb at 70 kts at 1500 fpm
			70	Level Flight
			85	Level Flight
			105	Level Flight
			119	Level Flight
			105	1.25g Right Turn
			105	1.25g Left Turn
			85	1.5g Right Turn
			85	1.5g Left Turn
			85	1.25g Pullup
			70	1.5g Pullup
			70	Turn Reversal: 45° Right to 45° Left
			70	Turn Reversal: 45° Left to 45° Right
		294	85	Autorotation
		324	85	Autorotation
		339	85	Autorotation
		324	0	Hover, ±10% Longitudinal Stick Reversal
			0	Hover, ±10% Lateral Stick Reversal
			0	Hover, ±10% Pedal Reversal
13	0.9	324	85	Climb at 500 fpm
			70	Level Flight
			85	Level Flight
			105	Level Flight
			119	Level Flight
			127	Level Flight
			105	1.25g Pullup
			105	1.5g Right Turn
			105	1.5g Left Turn
			119	1.25g Right Turn
			119	1.25g Left Turn
			70	1.75g Right Turn
			70	1.75g Left Turn
			85	1.5g Pullup
			85	Turn Reversal, 45° Right to 45° Left, Mild
			85	Turn Reversal, 45° Left to 45° Right, Mild
			105	Autorotation
			85	1.5g Right Turn
			85	1.5g Left Turn

TABLE E-1 - Continued

Flight Number	Time (hours)	RPM	Airspeed (knots)	Test Conditions
14	0.9	324	102	Climb at 500 fpm
			85	Climb at 1000 fpm
			70	Level Flight
			85	Level Flight
			105	Level Flight
			119	Level Flight
			127	Level Flight
			136	Level Flight
			127	1.25g Right Turn
			127	1.25g Left Turn
			119	1.25g Pullup
			85	1/2-Ball Left Sideslip
			85	1/2-Ball Right Sideslip
			105	1.5g Pullup
			105	Lateral Reversal, Mild
			105	Longitudinal Reversal, Mild
			105	Pedal Reversal, Mild
			119	Lateral Reversal, Mild
			119	Longitudinal Reversal, Mild
			119	Pedal Reversal, Mild
15	1.0	324	85	Climb at 1500 fpm
			102	Climb at 1000 fpm
			119	Climb at 500 fpm
			70	Level Flight
			85	Level Flight
			105	Level Flight
			119	Level Flight
			127	Level Flight
			136	Level Flight
			136	1.25g Right Turn
			136	1.25g Left Turn
			127	1.25g Pullup
			119	1.5g Right Turn
			119	1.5g Left Turn
			119	1.5g Pullup
			136	1/4-Ball Left Sideslip
			136	1/4-Ball Right Sideslip
			85	1 Ball Right Sideslip
			85	1 Ball Left Sideslip
16	0.5	324	0-136	Moderate Acceleration
			136	Climb at Maximum Power
			102	Climb at Maximum Power
			119	Climb at Maximum Power
			127	1.5g Right Turn
			127	1.5g Left Turn
			119	1.5g Pullup
			102	Turn Reversal, 45° Right to 45° Left, Mild
			102	Turn Reversal, 45° Left to 45° Right, Mild

TABLE E-1 - Continued

Flight Number	Time (hours)	RPM	Airspeed (knots)	Test Conditions
17	0.3	324	0-136	Accelerate at Maximum Power
			105	Level Flight
			85	1.5g Right Turn
			85	1.75g Right Turn
			85	1.5g Left Turn
			85	1.75g Left Turn
			119	1.5g Right Turn
			119	1.75g Right Turn
			119	1.5g Left Turn
			119	1.75g Left Turn
			70	Climb at Maximum Power
			70	Pushover to 0.75g
			119	Turn Reversal, 45° Left to 45° Right, Mild
			119	Turn Reversal, 45° Right to 45° Left, Mild
			136	1.5g Left Turn
			127	1.5g Pullup
			119	Descent at Torquemeter = 20 psi
			119	Descent Pullup at 1.25g at Torquemeter = 20 psi
			119	Descent at Torquemeter = 10 psi
			119	Descent Pullup at 1.25g at Torquemeter = 10 psi
			136-0	Approach with Moderate Flare
18	0.9	324	0-136	Accelerate at Maximum Power
			85	1.5g Right Turn
			85	1.75g Right Turn
			85	1.5g Left Turn
			85	1.75g Left Turn
			119	1.5g Right Turn
			119	1.75g Right Turn
			119	1.5g Left Turn
			119	1.75g Left Turn
			70	Climb at Maximum Power
			70	Pushover to 0.75g
			119	Turn Reversal, 45° Left to 45° Right, Mild
			119	Turn Reversal, 45° Right to 45° Left, Mild
			136	1.5g Left Turn
			127	1.5g Pullup
			119	Descent at Torquemeter = 20 psi
			119	Descent Pullup at 1.25g at Torquemeter = 20 psi
			119	Descent at Torquemeter = 10 psi
			119	Descent Pullup at 1.25g at Torquemeter = 10 psi
			136-0	Buildup to Quick Stop
19	0.9	324	0	Jump Takeoff -- Flat Pitch to 5 psi Over Hover Torque
			0	Jump Takeoff -- Light on Skids to 5 psi Over Hover Torque
			85	Level Flight
			105	Level Flight
			119	Level Flight
			127	Level Flight
			136	Level Flight
			119	Descent Pullup at 1.5g at Torquemeter = 20 psi
			85	1.9g Right Turn
			85	1.9g Left Turn
			119	1.8g Right Turn
			119	1.8g Left Turn
			105	1.8g Right Turn
			105	1.8g Left Turn

TABLE E-1 - Continued

Flight Number	Time (hours)	RPM	Airspeed (knots)	Test Conditions
19 (cont.)		324	136	Descent at Torquemeter = 20 psi
			136	Descent Pullup at 1.25g at Torquemeter = 20 psi
			136	Turn Reversal, 45° Left to 45° Right, Mild
			136	Turn Reversal, 45° Right to 45° Left, Mild
			136	Climb at Maximum Power
			136	Pushover to 0.75g
20	0.9	324	0	Jump Takeoff -- Flat Pitch to Torquemeter = 50 psi
			105	Turn Reversal, 45° Left to 45° Right, Moderate
			105	Turn Reversal, 45° Right to 45° Left, Moderate
			136	Turn Reversal, 45° Left to 45° Right, Moderate
			136	Turn Reversal, 45° Right to 45° Left, Moderate
			136	1/4-Ball Right Sideslip
			136	1/2-Ball Right Sideslip
			136	1/4-Ball Left Sideslip
			136	1/2-Ball Left Sideslip
			119	1.8g Left Turn
			65	Climb at Maximum Power
			65	Pushover to 0.5g
			136	Descent Pullup at 1.5g at Torquemeter = 20 psi
			119	Descent at Torquemeter = 20 psi
			119	45° Right Bank in Descent at Torquemeter = 20 psi
			119	45° Left Bank in Descent at Torquemeter = 20 psi
			136	Descent at Torquemeter = 20 psi
			136	45° Right Bank in Descent at Torquemeter = 20 psi
			136	45° Left Bank in Descent at Torquemeter = 20 psi
			136-0	Quick Stop
21	0.7	324	0	Hover
			5	Right Sideward Flight
			10	Right Sideward Flight
			15	Right Sideward Flight
			20	Right Sideward Flight
			24	Right Sideward Flight
			0	Hover
			5	Left Sideward Flight
			10	Left Sideward Flight
			15	Left Sideward Flight
			20	Left Sideward Flight
			24	Left Sideward Flight
			0	Hover
			5	Rearward Flight
			10	Rearward Flight
			119	Right Rolling Pullup to 1.6g at Torquemeter = 20 psi
			119	Left Rolling Pullup to 1.6g at Torquemeter = 20 psi
			136	Right Rolling Pullup to 1.5g at Torquemeter = 20 psi
			136	Left Rolling Pullup to 1.5g at Torquemeter = 20 psi

This concludes the basic flight test program for the MTS Blades.

TABLE E-2. ALLOWABLE LOADS FOR AH-1G MAIN ROTORS WITH MTS AND 540 BLADES

Meas. No.	Measurement	Allowable Loads			AH-1G	Maximum AH-1G Measured Loads (Full Flight Envelope)			Maximum Anticipated AH-1G Loads (Limited MTS Flight Envelope)(1)		
		End. Limit ±	10 Hour Allowable	1 Hour Allowable	Limit Load	Maneuver Max Load	Maneuver Max Alt Load	Stabilized Level Flt. Max Alt.	Maneuver Max Load	Maneuver Max Alt Load	Stabilized Level Flt Max Alt.
	M/R Blade Flap Bend Sta 48	42400	45450	47230	57500	46768	2730 ±38980	5895 ±23490	27720	1896 ±23175	690 ±13532
	M/R Flap Bend Sta 60	30400	32590	33870	40000	-33500	- 2420 ±31100	1034 ±18666	30767	- 4496 ±26271	- 2076 ±10024
	M/R Flap Bend Sta 85	13600	14580	15150	29220	-29220	- 4080 ±20900	1483 ±11800	-17370	- 2779 ±14590	- 74 ± 7568
	M/R Flap Bend Sta 110	13600	14580	15150	20800	-20800	- 3300 ±15600	166 ± 9121	-14120	- 2402 ±11318	- 1508 ± 6701
	M/R Flap Bend Sta 180	13600	14580	15150	22070	-22070	- 6400 ±15670	- 5416 ± 7637	-20830	- 6420 ±12400	- 3824 ± 5313
	M/R (6) Flap Bend Sta 220	13600	14580	15150	24910	-24910	- 8860 ±15200	-10179 ± 5521	-21048	- 8072 ±12976	- 8843 ± 3983
	M/R Chord Bend Sta 48	113600	123300	135500	430000	339600 (4)	106000 (4) ±153000	106220 (4) ±69800	267800 (4)	118900 (4) ±97290	117700 (4) ±40050
	M/R Chord Bend Sta 85	68170	73960	81330	428000	279400	146400 ±117200	162500 ±50900	261100	162100 ±99000	158844 ±36800
	M/R Chord Bend Sta 180	39400	42750	47000	110000	87240	31680 ±43660	44190 ±18810	76130	26540 ±43660	44630 ±17501
	M/R Blade (5) Torsion Sta 85	15580	16700	17360	27720	27720	6850 ±19830	2205 ± 8127	19080	3786 ±15290	2495 ± 4990
	M/R Blade Torsion Sta 180	11800	12650	13150	-	◁—— No Measured Loads ——▷					
	M/R Drag Lb. Brace Load	5920 (2) (11)	6423	7063	+20518 -14189	19124	5968 ± 8613	5981 ± 3930	15080	5700 ± 6307	6629 ± 2255
	M/R Pitch (1/rev) lb Link Axial Load	1580	3330	-	+ 4400 - 2550	4400	1087 ± 3148	629 ± 1071	3028	601 ± 2427	396 ± 792

TABLE E-2 - Continued

Meas. No.	Measurement	Allowable Loads			AH-1G	Maximum AH-1G Measured Loads (Full Flight Envelope)			Maximum Anticipated AH-1G Loads (Limited MTS Flight Envelope)(1)		
		End. Limit ±	10 Hour Allowable	1 Hour Allowable	Limit Load	Maneuver		Stabilized Level Flt. Max Alt.	Maneuver		Stabilized Level Flt. Max Alt.
						Max. Load	Max. Alt. Load		Max. Load	Max. Alt. Load	
	M/R Yoke Flap Bend Sta 4.8	See Note (3)			71987	-35186	3419 ±16239	-15112 ± 7583	22364	3777 ±11897	-21209 ± 4460
	M/R Yoke Chord Bend Sta 5.8				441000	314700	58443 ±175300	121947 ±82243	238770	93006 ±145760	82242 ±48211
	M/R Drive Shaft(7) Bending Moment - 0° (in line with blade)				-	-30490	- 452 ± 30040	- 640 ±11830	-30490	- 452 ± 30040	- 1544 ±11120
	M/R Drive Shaft Bending Moment -90° (7)	36000 psi	41000 psi	67000 psi	-	-30590	- 153 ± 30170	- 320 ±11550	-30590	- 908 ±29680	- 310 ±10530
	M/R Drive Shaft Torque 2/rev	Use Interaction Equation C			-	215550	40030 ± 38980	97882 ± 6247	200970	40030 ±38980	97882 ± 6247
	Vertical Acceleration at C.G. 2/rev g's				-	3.224	2.21 ± 1.014	1.033 ±0.431	2.591	2.068 ±0.523	1.022 ±0.309
	Lateral Boost lb. Actuator 2/rev	1290	2400	3700	-	- 4125	- 1623 ± 2502	- 545 ± 858	- 3231	- 1207 ± 2024	- 369 ± 642
	Lift Link 2/rev lb	This component is not a fatigue limited life part.				19067	10437 ± 5178	6875 ± 2378	15880	5586 ± 5054	6837 ± 1479

TABLE E-2 - Continued

General Notes

A load frequency of one/rev is assumed for all blades and rotating controls.

A load frequency of two/rev is assumed for main rotor drive shaft torque, vertical acceleration, lateral boost actuator, and lift link.

Positive flapwise bending denotes tension in lower side of blades, positive chordwise bending denotes tension in leading edge of blade, and positive axial load denotes tension.

Specific Notes

(1) Loads are within the flight envelope for the MTS blades, which is limited in speed and load factor to 80 percent of the AH-1G flight envelope, and to a gross weight of 8500 ± 200 pounds.

(2) Endurance limit is based on blade failure. The drag brace load is used in interaction equation A to establish the life of the main rotor grip.

(3) Measured loads are used in interaction equations A and B to establish the life of the main rotor grip and yoke extension, respectively.

(4) Measured load = 17.76 x measured drag brace load.

(5) Based on pitch link load.

(6) Measured loads are from Station 210.

(7) Measured loads are adjusted for HH location of the bending gages (different from Bell).

TABLE E-3. 540 ROTOR HUB LOAD INTERACTION EQUATIONS

INTERACTION EQUATION A (MAIN ROTOR GRIP)

$$f_{ALT} = 0.01646\, M_{F_{4.8}} + 0.08514\, M_{F_{48}} + 0.2667\, P_{DB}$$

where:

f_{ALT} = Alternating Stress - PSI

M_F = Alternating Flapwise Moment - in-lb

P_{DB} = Alternating Drag Brace Load - lb

Allowables (PSI)

324 RPM and 1/Rev Load Frequency Assumed

	Endurance Limit ±	10 Hour Allowable	1 Hour Allowable
f_{ALT}	6250	7700	14000

INTERACTION EQUATION B (MAIN ROTOR YOKE EXTENSION)

$$f_{ALT} = 0.809\, M_{F_{4.8}} + 0.274\, M_{F_{48}} + 0.0313\, M_{C_{5.8}} + 0.00968\, M_{C_{48}}$$

where:

M_C = Alternating Chord Moment - in-lb

M_F = Alternating Flapwise Moment - in-lb

TABLE E-3 - Continued

Allowables (PSI)

324 RPM and 1/Rev Load Frequency Assumed

	Endurance Limit ±	10 Hour Allowable	1 Hour Allowable
f_{ALT}	17100	25000	42500

INTERACTION EQUATION C (MAIN ROTOR MAST)

$$f_{ALT} = \left[(2498\ N_V + 0.9601\ M_R)^2 + 0.126\ (TOR)^2\right]^{1/2}$$

where:

f_{ALT} = Alternating Stress - PSI

N_V = Alternating Vertical Load Factor ~ g

M_R = The resultant of parallel and perpendicular alternating bending moments. in.-lb

TOR = Alternating Mast Torsion Load ~ in.-lb

TABLE E-4. AH-1G S/N 67-15683 HUGHES HELICOPTERS MULTI-TUBULAR SPAR ROTOR BLADES

PARAMETER M.R. HUB FLAP BENDING @ STA.5.0 UNITS IN-LB ENDURANCE LIMIT 7583. STATIC LIMITS +-71987.
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR		
2.	NORMAL SHUTDOWN 100-0%		
3.	NORMAL TAKEOFF		
4.	JUMP TAKEOFF	-2076.	3586.
5.	HOVER IGE 324 RPM	-3514.	2274.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	3859.	4341.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	-4462.	3980.
8.	HOVER, F/A REVERSAL	-5851.	3775.
9.	HOVER, LAT. REVERSAL	-7361.	4530.
10.	HOVER, DIR. REVERSAL	-8211.	2359.
11.	SIDEWARD FLIGHT - RIGHT	-6606.	6795.
12.	SIDEWARD FLIGHT - LEFT	-1964.	5892.
13.	REARWARD FLIGHT	-1550.	4238.
14.	LEVEL FLIGHT - 70 KIAS	-6512.	4624.
15.	LEVEL FLIGHT - 85 KIAS	-6512.	3869.
16.	LEVEL FLIGHT - 102 KIAS	-5663.	5851.
17.	LEVEL FLIGHT - 119 KIAS	-7349.	6791.
18.	LEVEL FLIGHT - 127 KIAS	-6606.	6418.
19.	LEVEL FLIGHT - 136 KIAS	-6606.	6795.
20.	CLIMB, 500 FPM - 70 KIAS	-4153.	3209.
21.	CLIMB, 1000 FPM - 70 KIAS	-6606.	2643.
22.	CLIMB, 1500 FPM - 70 KIAS	-5946.	2548.
23.	CLIMB, 500 FPM - 85 KIAS	-6140.	3535.
24.	CLIMB, 1000 FPM - 85 KIAS	-5283.	3398.
25.	CLIMB, 1500 FPM - 85 KIAS	-5024.	3163.
26.	CLIMB, 500 FPM - 105 KIAS	-7833.	4436.
27.	CLIMB, 1000 FPM - 105 KIAS ...	-6326.	4465.
28.	CLIMB, 500 FPM - 119 KIAS	-6791.	6047.
29.	CLIMB, MAX.RATE - 70 KIAS	-3397.	2453.
30.	CLIMB, MAX.RATE - 105 KIAS ...	-5303.	4000.
31.	CLIMB, MAX.RATE - 119 KIAS ...	-5954.	5396.
32.	CLIMB, MAX.RATE - 136 KIAS ...	-2698.	6977.
33.	LEFT TURN, 70 KIAS	7349.	10885.
34.	LEFT TURN, 85 KIAS	2419.	12280.
35.	LEFT TURN, 105 KIAS	5582.	9861.
36.	LEFT TURN, 119 KIAS	9721.	10287.
37.	LEFT TURN, 127 KIAS	3721.	10047.
38.	LEFT TURN, 136 KIAS	6511.	10475.
39.	RIGHT TURN, 70 KIAS	-186.	8000.
40.	RIGHT TURN, 85 KIAS	12652.	9117.
41.	RIGHT TURN, 105 KIAS	6134.	9909.
42.	RIGHT TURN, 119 KIAS	11908.	10233.
43.	RIGHT TURN, 127 KIAS	7256.	10047.
44.	RIGHT TURN, 136 KIAS	-4745.	11629.
45.	TURN REVERSAL, MILD - 70 KIAS .	-6889.	8588.
46.	TURN REVERSAL, MILD - 85 KIAS .	2884.	8838.
47.	TURN REVERSAL, MILD - 105 KIAS	3814.	10698.
48.	TURN REVERSAL, MILD - 119 KIAS	2453.	10570.
49.	TURN REVERSAL, MILD - 136 KIAS	3907.	9675.
50.	TURN REVERSAL, MOD. - 105 KIAS	5851.	10759.

NO.	TEST CONDITION	MEAN.	OSC.
51.	TURN REVERSAL, MOD. - 136 KIAS	3869.	12174.
52.	F/A CONT. REVERSAL - 119 KIAS	-5851.	11136.
53.	LAT. CONT. REVERSAL- 119 KIAS	-6701.	7644.
54.	DIR. CONT. REVERSAL - 119 KIAS	-6701.	6134.
55.	PULLUP, LEVEL FLIGHT - 70 KIAS	7267.	7644.
56.	PULLUP, LEVEL FLIGHT - 85 KIAS	4930.	6419.
57.	PULLUP, LEVEL FLIGHT- 105 KIAS	3020.	9438.
58.	PULLUP, LEVEL FLIGHT- 119 KIAS	3628.	9582.
59.	PULLUP, LEVEL FLIGHT- 127 KIAS	3114.	8776.
60.	PULLUP, DIVE - 136 KIAS	4341.	8871.
61.	AUTOROTATION ENTRY - 70 KIAS ..	-15194.	4624.
62.	STAB. AUTO, 324 RPM - 70 KIAS .	-8777.	4624.
63.	STAB. AUTO, 324 RPM - 85 KIAS .	-8966.	5757.
64.	STAB. AUTO, 324 RPM - 105 KIAS	-9210.	5861.
65.	STAB. AUTO, 294 RPM - 85 KIAS .	94.	5002.
66.	STAB. AUTO, 339 RPM - 85 KIAS .	-10759.	6229.
67.	AUTO TURN, RIGHT - 70 KIAS	-1888.	5285.
68.	AUTO TURN, LEFT - 70 KIAS	-9909.	4813.
69.	AUTO PWR. RECOVERY	5285.	6795.
70.	APPROACH AND FLARE TO HOVER ...	-6606.	8305.
71.	LEFT SIDESLIP - 70 KIAS	-8116.	4341.
72.	LEFT SIDESLIP - 85 KIAS	-8559.	3535.
73.	LEFT SIDESLIP - 136 KIAS	-6977.	6977.
74.	RIGHT SIDESLIP - 70 KIAS	-7361.	3775.
75.	RIGHT SIDESLIP - 85 KIAS	-6977.	4186.
76.	RIGHT SIDESLIP - 136 KIAS	-5285.	7550.
77.	DIVE, STEADY - 119 KIAS	-9060.	7361.
78.	DIVE, STEADY - 136 KIAS	-8777.	8211.
79.	DIVE, RIGHT TURN - 119 KIAS ...	2737.	8966.
80.	DIVE, LEFT TURN - 119 KIAS	-2548.	7833.
81.	DIVE, RIGHT TURN - 136 KIAS ...	566.	9249.
82.	DIVE, LEFT TURN - 136 KIAS ...	4719.	9438.
83.	DIVE, RT. TURN PULLUP- 119 KIAS	-5001.	8400.
84.	DIVE, LT. TURN PULLUP- 119 KIAS	3586.	8871.
85.	DIVE, RT. TURN PULLUP- [illegible]	[illegible]	[illegible]
86.	DIVE, LT. TURN PULLUP- 136 KIAS	-1698.	9060.
87.	DIVE, PULLUP - 119 KIAS	651.	8838.
88.	CLIMB, MAX. RATE, PUSHOVER- 70	[illegible]	[illegible]
89.	CLIMB, MAX. RATE, PUSHOVER- 136	-27537.	5582.
90.	CLIMB, MAX. RATE, PUSHOVER- 85	-20385.	2454.
91.	QUICK STOP - 136 KIAS TO HOVER.	-10853.	8966.

TABLE E-4 - Continued

PARAMETER M.R. BLADE FLAP BENDING @ STA.48 UNITS IN-LB ENDURANCE LIMIT 42400. STATIC LIMITS +-57500.
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR			51.	TURN REVERSAL, MOD. - 136 KIAS	15332.	31192.
2.	NORMAL SHUTDOWN 100-0%			52.	F/A CONT. REVERSAL - 119 KIAS	11865.	22333.
3.	NORMAL TAKEOFF			53.	LAT. CONT. REVERSAL- 119 KIAS	10120.	18844.
4.	JUMP TAKEOFF	9340.	8635.	54.	DIR. CONT. REVERSAL - 119 KIAS	9247.	15180.
5.	HOVER IGE 324 RPM	9828.	4744.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	14482.	16576.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	11292.	7870.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	18146.	17099.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	11463.	5304.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	11690.	17971.
8.	HOVER, F/A REVERSAL	14133.	11341.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	14339.	21250.
9.	HOVER, LAT. REVERSAL	11865.	10469.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	13436.	19716.
10.	HOVER, DIR. REVERSAL	11690.	4013.	60.	PULLUP, DIVE - 136 KIAS	7049.	16918.
11.	SIDEWARD FLIGHT - RIGHT	11167.	10119.	61.	AUTOROTATION ENTRY - 70 KIAS ..	6630.	7328.
12.	SIDEWARD FLIGHT - LEFT	10336.	8308.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	5874.	7602.
13.	REARWARD FLIGHT	11183.	8811.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	5183.	8639.
14.	LEVEL FLIGHT - 70 KIAS	8897.	10608.	64.	STAB. AUTO, 324 RPM - 105 KIAS	3839.	11865.
15.	LEVEL FLIGHT - 85 KIAS	12563.	10469.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	8026.	10120.
16.	LEVEL FLIGHT - 102 KIAS	8639.	12439.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	6979.	9073.
17.	LEVEL FLIGHT - 119 KIAS	11516.	16751.	67.	AUTO TURN, RIGHT - 70 KIAS	9502.	8466.
18.	LEVEL FLIGHT - 127 KIAS	10992.	18320.	68.	AUTO TURN, LEFT - 70 KIAS	5010.	8120.
19.	LEVEL FLIGHT - 136 KIAS	11342.	20414.	69.	AUTO PWR. RECOVERY	14340.	15031.
20.	CLIMB, 500 FPM - 70 KIAS			70.	APPROACH AND FLARE TO HOVER ...	9330.	17968.
21.	CLIMB, 1000 FPM - 70 KIAS	10539.	6738.	71.	LEFT SIDESLIP - 70 KIAS	8639.	8639.
22.	CLIMB, 1500 FPM - 70 KIAS	11167.	8026.	72.	LEFT SIDESLIP - 85 KIAS	10094.	7699.
23.	CLIMB, 500 FPM - 85 KIAS	11167.	8026.	73.	LEFT SIDESLIP - 136 KIAS	8897.	19162.
24.	CLIMB, 1000 FPM - 85 KIAS	10643.	8550.	74.	RIGHT SIDESLIP - 70 KIAS	9675.	9675.
25.	CLIMB, 1500 FPM - 85 KIAS	12318.	8897.	75.	RIGHT SIDESLIP - 85 KIAS	10779.	9068.
26.	CLIMB, 500 FPM - 105 KIAS	9971.	10818.	76.	RIGHT SIDESLIP - 136 KIAS	10750.	20618.
27.	CLIMB, 1000 FPM - 105 KIAS	11292.	12318.	77.	DIVE, STEADY - 119 KIAS	4934.	16565.
28.	CLIMB, 500 FPM - 119 KIAS	9752.	15911.	78.	DIVE, STEADY - 136 KIAS	3800.	16239.
29.	CLIMB, MAX.RATE - 70 KIAS	16227.	7852.	79.	DIVE, RIGHT TURN - 119 KIAS ...	10750.	15332.
30.	CLIMB, MAX.RATE - 105 KIAS	15549.	13130.	80.	DIVE, LEFT TURN - 119 KIAS	9340.	18151.
31.	CLIMB, MAX.RATE - 119 KIAS	14339.	17104.	81.	DIVE, RIGHT TURN - 136 KIAS ...	9340.	17799.
32.	CLIMB, MAX.RATE - 136 KIAS	15203.	20041.	82.	DIVE, LEFT TURN - 136 KIAS ...	11455.	14979.
33.	LEFT TURN, 70 KIAS	12388.	19716.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	18670.	19367.
34.	LEFT TURN, 85 KIAS	13609.	16750.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	14481.	15528.
35.	LEFT TURN, 105 KIAS	17274.	21810.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	[illegible]	15877.
36.	LEFT TURN, 119 KIAS	18504.	22381.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	10992.	17273.
37.	LEFT TURN, 127 KIAS	15030.	21250.	87.	DIVE, PULLUP - 119 KIAS	12093.	16930.
38.	LEFT TURN, 136 KIAS	12214.	22333.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	[illegible]	9247.
39.	RIGHT TURN, 70 KIAS	21810.	22857.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	10538.	21595.
40.	RIGHT TURN, 85 KIAS	18669.	23904.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	8635.	7930.
41.	RIGHT TURN, 105 KIAS	15703.	21636.	91.	QUICK STOP - 136 KIAS TO HOVER.	5815.	17799
42.	RIGHT TURN, 119 KIAS	17622.	19004.				
43.	RIGHT TURN, 127 KIAS	16240.	17622.				
44.	RIGHT TURN, 136 KIAS	12147.	23097.				
45.	TURN REVERSAL, MILD - 70 KIAS .	15180.	16925.				
46.	TURN REVERSAL, MILD - 85 KIAS .	16925.	20414.				
47.	TURN REVERSAL, MILD - 105 KIAS	13303.	26779.				
48.	TURN REVERSAL, MILD - 119 KIAS	13784.	21112.				
49.	TURN REVERSAL, MILD - 136 KIAS	12439.	22804.				
50.	TURN REVERSAL, MOD. - 105 KIAS	13746.	27844.				

TABLE E-4 - Continued

PARAMETER M.R. BLADE FLAP BENDING @ STA.60 UNITS IN-LB ENDURANCE LIMIT 30400. STATIC LIMITS +-40000.
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR		
2.	NORMAL SHUTDOWN 100-0%		
3.	NORMAL TAKEOFF		
4.	JUMP TAKEOFF	5794.	6094.
5.	HOVER IGE 324 RPM		
6.	HOVER TURN, RIGHT 30 DEG/SEC ..		
7.	HOVER TURN, LEFT 30 DEG/SEC ..		
8.	HOVER, F/A REVERSAL	8532.	8125.
9.	HOVER, LAT. REVERSAL	7313.	6907.
10.	HOVER, DIR. REVERSAL	7110.	2641.
11.	SIDEWARD FLIGHT - RIGHT	3400.	7000.
12.	SIDEWARD FLIGHT - LEFT	6199.	5000.
13.	REARWARD FLIGHT	6600.	5800.
14.	LEVEL FLIGHT - 70 KIAS	3800.	7400.
15.	LEVEL FLIGHT - 85 KIAS	6000.	7999.
16.	LEVEL FLIGHT - 102 KIAS	4599.	9398.
17.	LEVEL FLIGHT - 119 KIAS	6500.	12188.
18.	LEVEL FLIGHT - 127 KIAS	6094.	13813.
19.	LEVEL FLIGHT - 136 KIAS	5998.	15197.
20.	CLIMB, 500 FPM - 70 KIAS		
21.	CLIMB, 1000 FPM - 70 KIAS	6599.	5399.
22.	CLIMB, 1500 FPM - 70 KIAS	7110.	5891.
23.	CLIMB, 500 FPM - 85 KIAS	6907.	6500.
24.	CLIMB, 1000 FPM - 85 KIAS	5800.	7798.
25.	CLIMB, 1500 FPM - 85 KIAS	7998.	6800.
26.	CLIMB, 500 FPM - 105 KIAS	6000.	7998.
27.	CLIMB, 1000 FPM - 105 KIAS	7000.	8598.
28.	CLIMB, 500 FPM - 119 KIAS	5800.	11798.
29.	CLIMB, MAX.RATE - 70 KIAS	10969.	6094.
30.	CLIMB, MAX.RATE - 105 KIAS	10969.	9344.
31.	CLIMB, MAX.RATE - 119 KIAS	9750.	12594.
32.	CLIMB, MAX.RATE - 136 KIAS	10157.	15032.
33.	LEFT TURN, 70 KIAS	5891.	11579.
34.	LEFT TURN, 85 KIAS	9598.	11998.
35.	LEFT TURN, 105 KIAS	9141.	14829.
36.	LEFT TURN, 119 KIAS	9547.	14829.
37.	LEFT TURN, 127 KIAS	8735.	15235.
38.	LEFT TURN, 136 KIAS	14422.	16047.
39.	RIGHT TURN, 70 KIAS	13000.	15438.
40.	RIGHT TURN, 85 KIAS	10516.	17062.
41.	RIGHT TURN, 105 KIAS	5485.	14016.
42.	RIGHT TURN, 119 KIAS	9998.	13597.
43.	RIGHT TURN, 127 KIAS	11985.	14829.
44.	RIGHT TURN, 136 KIAS	6600.	18996.
45.	TURN REVERSAL, MILD - 70 KIAS .	9750.	10969.
46.	TURN REVERSAL, MILD - 85 KIAS .	9141.	14829.
47.	TURN REVERSAL, MILD - 105 KIAS	5891.	18079.
48.	TURN REVERSAL, MILD - 119 KIAS	5484.	18078.
49.	TURN REVERSAL, MILD - 136 KIAS	6399.	18396.
50.	TURN REVERSAL, MOD. - 105 KIAS	5891.	18892.

NO.	TEST CONDITION	MEAN.	OSC.
51.	TURN REVERSAL, MOD. - 136 KIAS	8125.	23157.
52.	F/A CONT. REVERSAL - 119 KIAS	6600.	16197.
53.	LAT. CONT. REVERSAL- 119 KIAS	5000.	13797.
54.	DIR. CONT. REVERSAL - 119 KIAS	5000.	11798.
55.	PULLUP, LEVEL FLIGHT - 70 KIAS	8329.	9954.
56.	PULLUP, LEVEL FLIGHT - 85 KIAS	10360.	12391.
57.	PULLUP, LEVEL FLIGHT- 105 KIAS	5599.	13197.
58.	PULLUP, LEVEL FLIGHT- 119 KIAS	9750.	14219.
59.	PULLUP, LEVEL FLIGHT- 127 KIAS	7718.	14219.
60.	PULLUP, DIVE - 136 KIAS	6094.	12594.
61.	AUTOROTATION ENTRY - 70 KIAS ..		
62.	STAB. AUTO, 324 RPM - 70 KIAS .	3000.	6200.
63.	STAB. AUTO, 324 RPM - 85 KIAS .	2000.	7598.
64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	9344.
65.	STAB. AUTO, 294 RPM - 85 KIAS .	4063.	8532.
66.	STAB. AUTO, 339 RPM - 85 KIAS .	3047.	7922.
67.	AUTO TURN, RIGHT - 70 KIAS	4800.	6400.
68.	AUTO TURN, LEFT - 70 KIAS	2599.	6199.
69.	AUTO PWR. RECOVERY	7598.	11198.
70.	APPROACH AND FLARE TO HOVER ...	4800.	12797.
71.	LEFT SIDESLIP - 70 KIAS	4400.	6000.
72.	LEFT SIDESLIP - 85 KIAS	6600.	5800.
73.	LEFT SIDESLIP - 136 KIAS	5600.	14797.
74.	RIGHT SIDESLIP - 70 KIAS	5600.	6800.
75.	RIGHT SIDESLIP - 85 KIAS	6800.	6000.
76.	RIGHT SIDESLIP - 136 KIAS	6094.	15845.
77.	DIVE, STEADY - 119 KIAS	1219.	11782.
78.	DIVE, STEADY - 136 KIAS	-406.	13407.
79.	DIVE, RIGHT TURN - 119 KIAS ...	6297.	11985.
80.	DIVE, LEFT TURN - 119 KIAS ...	3656.	12594.
81.	DIVE, RIGHT TURN - 136 KIAS ...	3860.	14422.
82.	DIVE, LEFT TURN - 136 KIAS ...	6500.	13000.
83.	DIVE, RT. TURN PULLUP- 119 KIAS	3999.	11597.
84.	DIVE, LT. TURN PULLUP- 119 KIAS	6998.	9398.
85.	DIVE, RT. TURN PULLUP- 136 KIAS	2799.	12797.
86.	DIVE, LT. TURN PULLUP- 136 KIAS	-200.	13797.
87.	DIVE, PULLUP - 119 KIAS	7598.	12397.
88.	CLIMB, MAX. RATE, PUSHOVER- 70	6297.	6703.
89.	CLIMB, MAX. RATE, PUSHOVER- 136	6799.	15997.
90.	CLIMB, MAX. RATE, PUSHOVER- 65	5485.	5891.
91.	QUICK STOP - 136 KIAS TO HOVER.	1422.	13204.

TABLE E-4 - Continued

PARAMETER M.R. BLADE FLAP BENDING @ STA.85 UNITS IN-LB ENDURANCE LIMIT 13600. STATIC LIMITS +-29220.
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR			51.	TURN REVERSAL, MOD. - 136 KIAS	2797.	11024.
2.	NORMAL SHUTDOWN 100-0%			52.	F/A CONT. REVERSAL - 119 KIAS	4443.	7075.
3.	NORMAL TAKEOFF			53.	LAT. CONT. REVERSAL- 119 KIAS	3538.	6828.
4.	JUMP TAKEOFF	3702.	2386.	54.	DIR. CONT. REVERSAL - 119 KIAS	3949.	6253.
5.	HOVER IGE 324 RPM	4030.	1613.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	4689.	4525.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	5480.	2095.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	5101.	4772.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	5480.	1451.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	3702.	7651.
8.	HOVER, F/A REVERSAL	5183.	2379.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	4195.	7815.
9.	HOVER, LAT. REVERSAL	4689.	2057.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	4114.	8062.
10.	HOVER, DIR. REVERSAL	4854.	1070.	60.	PULLUP, DIVE - 136 KIAS	2550.	8145.
11.	SIDEWARD FLIGHT - RIGHT	3784.	3291.	61.	AUTOROTATION ENTRY - 70 KIAS ..	3949.	3126.
12.	SIDEWARD FLIGHT - LEFT	3868.	3062.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	3465.	3304.
13.	REARWARD FLIGHT	4674.	1934.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	2498.	4755.
14.	LEVEL FLIGHT - 70 KIAS	4525.	3538.	64.	STAB. AUTO, 324 RPM - 105 KIAS	1234.	6335.
15.	LEVEL FLIGHT - 85 KIAS	5512.	3702.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	3209.	5512.
16.	LEVEL FLIGHT - 102 KIAS	4525.	5348.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	3044.	4854.
17.	LEVEL FLIGHT - 119 KIAS	4278.	6253.	67.	AUTO TURN, RIGHT - 70 KIAS	3707.	3385.
18.	LEVEL FLIGHT - 127 KIAS	4031.	6993.	68.	AUTO TURN, LEFT - 70 KIAS	3304.	2982.
19.	LEVEL FLIGHT - 136 KIAS	3702.	7980.	69.	AUTO PWR. RECOVERY	4594.	5238.
20.	CLIMB, 500 FPM - 70 KIAS	5183.	3209.	70.	APPROACH AND FLARE TO HOVER ...	3304.	5077.
21.	CLIMB, 1000 FPM - 70 KIAS	5077.	2821.	71.	LEFT SIDESLIP - 70 KIAS	4271.	3143.
22.	CLIMB, 1500 FPM - 70 KIAS	5101.	2962.	72.	LEFT SIDESLIP - 85 KIAS	4835.	3227.
23.	CLIMB, 500 FPM - 85 KIAS	5018.	3702.	73.	LEFT SIDESLIP - 136 KIAS	3062.	7737.
24.	CLIMB, 1000 FPM - 85 KIAS	5018.	3538.	74.	RIGHT SIDESLIP - 70 KIAS	4594.	3465.
25.	CLIMB, 1500 FPM - 85 KIAS	5158.	3385.	75.	RIGHT SIDESLIP - 85 KIAS	4594.	3788.
26.	CLIMB, 500 FPM - 105 KIAS	4525.	4360.	76.	RIGHT SIDESLIP - 136 KIAS	3620.	8392.
27.	CLIMB, 1000 FPM - 105 KIAS	4271.	4594.	77.	DIVE, STEADY - 119 KIAS	2386.	6828.
28.	CLIMB, 500 FPM - 119 KIAS	3304.	6044.	78.	DIVE, STEADY - 136 KIAS	1563.	7980.
29.	CLIMB, MAX.RATE - 70 KIAS	6664.	2879.	79.	DIVE, RIGHT TURN - 119 KIAS ...	3291.	7569.
30.	CLIMB, MAX.RATE - 105 KIAS	6087.	4771.	80.	DIVE, LEFT TURN - 119 KIAS	2304.	6911.
31.	CLIMB, MAX.RATE - 119 KIAS	5512.	6334.	81.	DIVE, RIGHT TURN - 136 KIAS ...	2304.	9214.
32.	CLIMB, MAX.RATE - 136 KIAS	4853.	7815.	82.	DIVE, LEFT TURN - 136 KIAS ...	2962.	8721.
33.	LEFT TURN, 70 KIAS	5101.	4772.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	2961.	7404.
34.	LEFT TURN, 85 KIAS	4772.	5923.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	4031.	6334.
35.	LEFT TURN, 105 KIAS	5100.	6746.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	3044.	8638.
36.	LEFT TURN, 119 KIAS	4031.	7816.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	3043.	8309.
37.	LEFT TURN, 127 KIAS	3948.	8391.	87.	DIVE, PULLUP - 119 KIAS	4278.	7568.
38.	LEFT TURN, 136 KIAS	5759.	9379.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	5265.	3126.
39.	RIGHT TURN, 70 KIAS	5101.	6417.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	6417.	7075.
40.	RIGHT TURN, 85 KIAS	3949.	6582.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	5265.	2633.
41.	RIGHT TURN, 105 KIAS	3291.	8392.	91.	QUICK STOP - 136 KIAS TO HOVER.	2304.	7898.
42.	RIGHT TURN, 119 KIAS	4936.	8227.				
43.	RIGHT TURN, 127 KIAS	5100.	8391.				
44.	RIGHT TURN, 136 KIAS	3143.	10396.				
45.	TURN REVERSAL, MILD - 70 KIAS .	4689.	4699.				
46.	TURN REVERSAL, MILD - 85 KIAS .	3538.	6499.				
47.	TURN REVERSAL, MILD - 105 KIAS	2797.	8227.				
48.	TURN REVERSAL, MILD - 119 KIAS	3455.	9708.				
49.	TURN REVERSAL, MILD - 136 KIAS	4195.	10119.				
50.	TURN REVERSAL, MOD. - 105 KIAS	2139.	7898.				

TABLE E-4 - Continued

PARAMETER M.R. BLADE FLAP BENDING @ STA.110 UNITS IN-LB ENDURANCE LIMIT 13600. STATIC LIMITS +-20800.
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR			51.	TURN REVERSAL, MOD. - 136 KIAS	3588.	7956.
2.	NORMAL SHUTDOWN 100-0%			52.	F/A CONT. REVERSAL - 119 KIAS	4602.	6006.
3.	NORMAL TAKEOFF			53.	LAT. CONT. REVERSAL- 119 KIAS	4212.	5616.
4.	JUMP TAKEOFF	3900.	1716.	54.	DIR. CONT. REVERSAL - 119 KIAS	4524.	5460.
5.	HOVER IGE 324 RPM	4894.	1376.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	4446.	3510.
6.	HOVER TURN, RIGHT 30 DEG/SEC	6653.	1759.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	4914.	4602.
7.	HOVER TURN, LEFT 30 DEG/SEC	6194.	994.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	3432.	6708.
8.	HOVER, F/A REVERSAL	5616.	1560.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	3822.	6786.
9.	HOVER, LAT. REVERSAL	5538.	1170.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	3978.	6474.
10.	HOVER, DIR. REVERSAL	5382.	1014.	60.	PULLUP, DIVE - 136 KIAS	3120.	6864.
11.	SIDEWARD FLIGHT - RIGHT	4290.	2730.	61.	AUTOROTATION ENTRY - 70 KIAS	4680.	2808.
12.	SIDEWARD FLIGHT - LEFT	4512.	2676.	62.	STAB. AUTO, 324 RPM - 70 KIAS	4134.	2886.
13.	REARWARD FLIGHT	5582.	2218.	63.	STAB. AUTO, 324 RPM - 85 KIAS	3900.	3588.
14.	LEVEL FLIGHT - 70 KIAS	4758.	3198.	64.	STAB. AUTO, 324 RPM - 105 KIAS	2886.	4758.
15.	LEVEL FLIGHT - 85 KIAS	5382.	3510.	65.	STAB. AUTO, 294 RPM - 85 KIAS	3900.	4368.
16.	LEVEL FLIGHT - 102 KIAS	4520.	4836.	66.	STAB. AUTO, 339 RPM - 85 KIAS	4212.	3588.
17.	LEVEL FLIGHT - 119 KIAS	3900.	5772.	67.	AUTO TURN, RIGHT - 70 KIAS	4212.	3276.
18.	LEVEL FLIGHT - 127 KIAS	4056.	6084.	68.	AUTO TURN, LEFT - 70 KIAS	4368.	2808.
19.	LEVEL FLIGHT - 136 KIAS	4368.	6552.	69.	AUTO PWR. RECOVERY	5070.	4602.
20.	CLIMB, 500 FPM - 70 KIAS	5850.	3042.	70.	APPROACH AND FLARE TO HOVER	5538.	4290.
21.	CLIMB, 1000 FPM - 70 KIAS	5928.	2496.	71.	LEFT SIDESLIP - 70 KIAS	5616.	2808.
22.	CLIMB, 1500 FPM - 70 KIAS	5538.	2574.	72.	LEFT SIDESLIP - 85 KIAS	5304.	3120.
23.	CLIMB, 500 FPM - 85 KIAS	5226.	3510.	73.	LEFT SIDESLIP - 136 KIAS	4446.	6474.
24.	CLIMB, 1000 FPM - 85 KIAS	5070.	3354.	74.	RIGHT SIDESLIP - 70 KIAS	5538.	3042.
25.	CLIMB, 1500 FPM - 85 KIAS	5616.	3276.	75.	RIGHT SIDESLIP - 85 KIAS	5304.	3744.
26.	CLIMB, 500 FPM - 105 KIAS	4836.	4212.	76.	RIGHT SIDESLIP - 136 KIAS	4446.	6786.
27.	CLIMB, 1000 FPM - 105 KIAS	4992.	4212.	77.	DIVE, STEADY - 119 KIAS	4056.	5616.
28.	CLIMB, 500 FPM - 119 KIAS	4446.	5538.	78.	DIVE, STEADY - 136 KIAS	3822.	6006.
29.	CLIMB, MAX.RATE - 70 KIAS	6552.	2652.	79.	DIVE, RIGHT TURN - 119 KIAS	3510.	6474.
30.	CLIMB, MAX.RATE - 105 KIAS	5928.	4212.	80.	DIVE, LEFT TURN - 119 KIAS	3510.	6006.
31.	CLIMB, MAX.RATE - 119 KIAS	5538.	5226.	81.	DIVE, RIGHT TURN - 136 KIAS	3120.	7644.
32.	CLIMB, MAX.RATE - 136 KIAS	5226.	6474.	82.	DIVE, LEFT TURN - 136 KIAS	3432.	7488.
33.	LEFT TURN, 70 KIAS	4290.	4602.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	3276.	6708.
34.	LEFT TURN, 85 KIAS	4524.	5148.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	3432.	5772.
35.	LEFT TURN, 105 KIAS	4602.	6474.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	3588.	7332.
36.	LEFT TURN, 119 KIAS	3354.	6942.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	3354.	7254.
37.	LEFT TURN, 127 KIAS	4134.	6786.	87.	DIVE, PULLUP - 119 KIAS	4368.	6084.
38.	LEFT TURN, 136 KIAS	4836.	7956.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	6318.	2106.
39.	RIGHT TURN, 70 KIAS	4914.	4290.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	7098.	4446.
40.	RIGHT TURN, 85 KIAS	4524.	4992.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	6240.	1716.
41.	RIGHT TURN, 105 KIAS	4290.	6474.	91.	QUICK STOP - 136 KIAS TO HOVER.	3666	6318.
42.	RIGHT TURN, 119 KIAS	3900.	7176.				
43.	RIGHT TURN, 127 KIAS	4212.	7332.				
44.	RIGHT TURN, 136 KIAS	4056.	8112.				
45.	TURN REVERSAL, MILD - 70 KIAS	4836.	2964.				
46.	TURN REVERSAL, MILD - 85 KIAS	4290.	5070.				
47.	TURN REVERSAL, MILD - 105 KIAS	4134.	6162.				
48.	TURN REVERSAL, MILD - 119 KIAS	4680.	7488.				
49.	TURN REVERSAL, MILD - 136 KIAS	4914.	8502.				
50.	TURN REVERSAL, MOD. - 105 KIAS	3120.	8240.				

TABLE E-4 - Continued

PARAMETER M.R. BLADE FLAP BENDING @ STA.185 UNITS IN-LB ENDURANCE LIMIT 13600. STATIC LIMITS +-22070.
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR		
2.	NORMAL SHUTDOWN 100-0%		
3.	NORMAL TAKEOFF		
4.	JUMP TAKEOFF	-1999.	2332.
5.	HOVER IGE 324 RPM	-1437.	1437.
6.	HOVER TURN, RIGHT 30 DEG/SEC	319.	2395.
7.	HOVER TURN, LEFT 30 DEG/SEC	240.	1677.
8.	HOVER, F/A REVERSAL	0.	2609.
9.	HOVER, LAT. REVERSAL	-652.	2936.
10.	HOVER, DIR. REVERSAL	-979.	1794.
11.	SIDEWARD FLIGHT - RIGHT	-1277.	3832.
12.	SIDEWARD FLIGHT - LEFT	-1517.	3114.
13.	REARWARD FLIGHT	-160.	2715.
14.	LEVEL FLIGHT - 70 KIAS	-1142.	3099.
15.	LEVEL FLIGHT - 85 KIAS	-571.	2854.
16.	LEVEL FLIGHT - 102 KIAS	-1631.	3751.
17.	LEVEL FLIGHT - 119 KIAS	-3180.	4485.
18.	LEVEL FLIGHT - 127 KIAS	-2283.	4730.
19.	LEVEL FLIGHT - 136 KIAS	-1794.	5056.
20.	CLIMB, 500 FPM - 70 KIAS	-1712.	2691.
21.	CLIMB, 1000 FPM - 70 KIAS	-1957.	2609.
22.	CLIMB, 1500 FPM - 70 KIAS	-2528.	2528.
23.	CLIMB, 500 FPM - 85 KIAS		
24.	CLIMB, 1000 FPM - 85 KIAS	-2691.	2854.
25.	CLIMB, 1500 FPM - 85 KIAS	-2609.	2773.
26.	CLIMB, 500 FPM - 105 KIAS	-2202.	3343.
27.	CLIMB, 1000 FPM - 105 KIAS	-2609.	3588.
28.	CLIMB, 500 FPM - 119 KIAS	-2446.	4240.
29.	CLIMB, MAX.RATE - 70 KIAS	-1416.	2583.
30.	CLIMB, MAX.RATE - 105 KIAS	-1386.	3506.
31.	CLIMB, MAX.RATE - 119 KIAS	-1304.	4240.
32.	CLIMB, MAX.RATE - 136 KIAS	-1875.	5137.
33.	LEFT TURN, 70 KIAS	-4485.	5953.
34.	LEFT TURN, 85 KIAS	-4892.	5544.
35.	LEFT TURN, 105 KIAS	-3750.	6523.
36.	LEFT TURN, 119 KIAS	-2832.	6331.
37.	LEFT TURN, 127 KIAS	-3180.	5952.
38.	LEFT TURN, 136 KIAS	-2083.	8915.
39.	RIGHT TURN, 70 KIAS	-4893.	4567.
40.	RIGHT TURN, 85 KIAS	-4666.	6165.
41.	RIGHT TURN, 105 KIAS	-4321.	6931.
42.	RIGHT TURN, 119 KIAS	-3180.	7420.
43.	RIGHT TURN, 127 KIAS	-2772.	7339.
44.	RIGHT TURN, 136 KIAS	-2120.	7665.
45.	TURN REVERSAL, MILD - 70 KIAS	-2446.	5382.
46.	TURN REVERSAL, MILD - 85 KIAS		
47.	TURN REVERSAL, MILD - 105 KIAS	-3914.	5545.
48.	TURN REVERSAL, MILD - 119 KIAS	-2416.	6915.
49.	TURN REVERSAL, MILD - 136 KIAS	-1712.	7094.
50.	TURN REVERSAL, MOD. - 105 KIAS	-4249.	5415.

NO.	TEST CONDITION	MEAN.	OSC.
51.	TURN REVERSAL, MOD. - 136 KIAS	-1916.	8248.
52.	F/A CONT. REVERSAL - 119 KIAS	-3425.	5545.
53.	LAT. CONT. REVERSAL- 119 KIAS	-2773.	4730.
54.	DIR. CONT. REVERSAL - 119 KIAS	-1794.	4240.
55.	PULLUP, LEVEL FLIGHT - 70 KIAS	-4322.	4485.
56.	PULLUP, LEVEL FLIGHT - 85 KIAS	-2609.	3425.
57.	PULLUP, LEVEL FLIGHT- 105 KIAS	-3751.	5382.
58.	PULLUP, LEVEL FLIGHT- 119 KIAS	-2854.	6605.
59.	PULLUP, LEVEL FLIGHT- 127 KIAS	-3249.	6415.
60.	PULLUP, DIVE - 136 KIAS	-3082.	6248.
61.	AUTOROTATION ENTRY - 70 KIAS	-1142.	2609.
62.	STAB. AUTO, 324 RPM - 70 KIAS	-2039.	1876.
63.	STAB. AUTO, 324 RPM - 85 KIAS	-2691.	2691.
64.	STAB. AUTO, 324 RPM - 105 KIAS		
65.	STAB. AUTO, 294 RPM - 85 KIAS	-3180.	3343.
66.	STAB. AUTO, 339 RPM - 85 KIAS	-1794.	2773.
67.	AUTO TURN, RIGHT - 70 KIAS	-3425.	2609.
68.	AUTO TURN, LEFT - 70 KIAS	-2120.	2283.
69.	AUTO PWR. RECOVERY	-3099.	3914.
70.	APPROACH AND FLARE TO HOVER	-1142.	5545.
71.	LEFT SIDESLIP - 70 KIAS	-897.	2854.
72.	LEFT SIDESLIP - 85 KIAS	-2609.	4893.
73.	LEFT SIDESLIP - 136 KIAS	-1313.	4332.
74.	RIGHT SIDESLIP - 70 KIAS	-1142.	2609.
75.	RIGHT SIDESLIP - 85 KIAS	-1142.	3262.
76.	RIGHT SIDESLIP - 136 KIAS	-1832.	5498.
77.	DIVE, STEADY - 119 KIAS	-1582.	4249.
78.	DIVE, STEADY - 136 KIAS	-1956.	5055.
79.	DIVE, RIGHT TURN - 119 KIAS	-2582.	5248.
80.	DIVE, LEFT TURN - 119 KIAS	-3415.	5082.
81.	DIVE, RIGHT TURN - 136 KIAS	-2166.	6165.
82.	DIVE, LEFT TURN - 136 KIAS	-2500.	6331.
83.	DIVE, RT. TURN PULLUP- 119 KIAS	-3353.	6706.
84.	DIVE, LT. TURN PULLUP- 119 KIAS	-4471.	6067.
85.	DIVE, RT. TURN PULLUP- 136 KIAS	-1117.	7186.
86.	DIVE, LT. TURN PULLUP- 136 KIAS	-3512.	6706.
87.	DIVE, PULLUP - 119 KIAS	-2283.	5544.
88.	CLIMB, MAX. RATE, PUSHOVER- 70	-583.	1916.
89.	CLIMB, MAX. RATE, PUSHOVER- 136	1875.	3995.
90.	CLIMB, MAX. RATE, PUSHOVER- 65	-916.	1749.
91.	QUICK STOP - 136 KIAS TO HOVER.	-1166.	5498.

TABLE E-4 - Continued

PARAMETER M.R. BLADE FLAP BENDING @ STA.220 UNITS IN-LB ENDURANCE LIMIT 13600. STATIC LIMITS +-24910.
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR		
2.	NORMAL SHUTDOWN 100-0%		
3.	NORMAL TAKEOFF		
4.	JUMP TAKEOFF	-4137.	2578.
5.	HOVER IGE 324 RPM	-2323.	1394.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	-3831.	3260.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	-3603.	2573.
8.	HOVER, F/A REVERSAL	-2818.	3297.
9.	HOVER, LAT. REVERSAL	-3237.	3477.
10.	HOVER, DIR. REVERSAL	-3777.	1858.
11.	SIDEWARD FLIGHT - RIGHT	-3537.	4616.
12.	SIDEWARD FLIGHT - LEFT	-2497.	3659.
13.	REARWARD FLIGHT	-987.	4008.
14.	LEVEL FLIGHT - 70 KIAS	-3186.	3540.
15.	LEVEL FLIGHT - 85 KIAS	-4189.	2183.
16.	LEVEL FLIGHT - 102 KIAS	-4307.	3127.
17.	LEVEL FLIGHT - 119 KIAS	-3363.	3599.
18.	LEVEL FLIGHT - 127 KIAS	-4307.	3717.
19.	LEVEL FLIGHT - 136 KIAS	-4012.	4720.
20.	CLIMB, 500 FPM - 70 KIAS	-2803.	3778.
21.	CLIMB, 1000 FPM - 70 KIAS	-4017.	1978.
22.	CLIMB, 1500 FPM - 70 KIAS	-4556.	2158.
23.	CLIMB, 500 FPM - 85 KIAS	-4496.	1978.
24.	CLIMB, 1000 FPM - 85 KIAS	-4130.	2478.
25.	CLIMB, 1500 FPM - 85 KIAS	-5369.	1947.
26.	CLIMB, 500 FPM - 105 KIAS	-3658.	2950.
27.	CLIMB, 1000 FPM - 105 KIAS	-5133.	2183.
28.	CLIMB, 500 FPM - 119 KIAS	-4661.	2773.
29.	CLIMB, MAX.RATE - 70 KIAS	-5179.	2254.
30.	CLIMB, MAX.RATE - 105 KIAS	-4736.	2338.
31.	CLIMB, MAX.RATE - 119 KIAS	-4556.	2878.
32.	CLIMB, MAX.RATE - 136 KIAS	-4856.	3777.
33.	LEFT TURN, 70 KIAS	-5575.	8933.
34.	LEFT TURN, 85 KIAS	-3717.	9112.
35.	LEFT TURN, 105 KIAS	-5695.	6654.
36.	LEFT TURN, 119 KIAS	-7134.	8333.
37.	LEFT TURN, 127 KIAS	-7014.	7494.
38.	LEFT TURN, 136 KIAS	-2742.	8591.
39.	RIGHT TURN, 70 KIAS	-3297.	7014.
40.	RIGHT TURN, 85 KIAS	-6234.	7433.
41.	RIGHT TURN, 105 KIAS	-7314.	7554.
42.	RIGHT TURN, 119 KIAS	-5935.	7853.
43.	RIGHT TURN, 127 KIAS	-4256.	8453.
44.	RIGHT TURN, 136 KIAS	-6018.	7198.
45.	TURN REVERSAL, MILD - 70 KIAS .	-3417.	6175.
46.	TURN REVERSAL, MILD - 85 KIAS .	-4976.	5695.
47.	TURN REVERSAL, MILD - 105 KIAS	-5036.	8513.
48.	TURN REVERSAL, MILD - 119 KIAS	-6702.	8774.
49.	TURN REVERSAL, MILD - 136 KIAS	-2938.	9292.
50.	TURN REVERSAL, MOD. - 105 KIAS	-5575.	8213.

NO.	TEST CONDITION	MEAN.	OSC.
51.	TURN REVERSAL, MOD. - 136 KIAS	-3417.	9892.
52.	F/A CONT. REVERSAL - 119 KIAS	-4130.	5192.
53.	LAT. CONT. REVERSAL- 119 KIAS	-4012.	5546.
54.	DIR. CONT. REVERSAL - 119 KIAS	-2714.	4484.
55.	PULLUP, LEVEL FLIGHT - 70 KIAS	-5216.	5096.
56.	PULLUP, LEVEL FLIGHT - 85 KIAS	-4736.	4976.
57.	PULLUP, LEVEL FLIGHT- 105 KIAS	-6608.	7198.
58.	PULLUP, LEVEL FLIGHT- 119 KIAS	-7014.	7853.
59.	PULLUP, LEVEL FLIGHT- 127 KIAS	-7007.	7860.
60.	PULLUP, DIVE - 136 KIAS	-5515.	7194.
61.	AUTOROTATION ENTRY - 70 KIAS ..		
62.	STAB. AUTO, 324 RPM - 70 KIAS .	-3357.	1559.
63.	STAB. AUTO, 324 RPM - 85 KIAS .	-3117.	2278.
64.	STAB. AUTO, 324 RPM - 105 KIAS	-2578.	3537.
65.	STAB. AUTO, 294 RPM - 85 KIAS .	-3897.	2578.
66.	STAB. AUTO, 339 RPM - 85 KIAS .	-3417.	2218.
67.	AUTO TURN, RIGHT - 70 KIAS	-4616.	2458.
68.	AUTO TURN, LEFT - 70 KIAS	-3417.	2218.
69.	AUTO PWR. RECOVERY	-4556.	2638.
70.	APPROACH AND FLARE TO HOVER ...	-2398.	7558.
71.	LEFT SIDESLIP - 70 KIAS	-2518.	2878.
72.	LEFT SIDESLIP - 85 KIAS	-3540.	2006.
73.	LEFT SIDESLIP - 136 KIAS	-4366.	3776.
74.	RIGHT SIDESLIP - 70 KIAS	-3237.	2758.
75.	RIGHT SIDESLIP - 85 KIAS	-4130.	2242.
76.	RIGHT SIDESLIP - 136 KIAS	-4256.	4496.
77.	DIVE, STEADY - 119 KIAS	-3177.	4736.
78.	DIVE, STEADY - 136 KIAS	-2158.	4916.
79.	DIVE, RIGHT TURN - 119 KIAS ...	-5755.	7554.
80.	DIVE, LEFT TURN - 119 KIAS	-4676.	6115.
81.	DIVE, RIGHT TURN - 136 KIAS ...	-3777.	6654.
82.	DIVE, LEFT TURN - 136 KIAS ...	-4736.	6654.
83.	DIVE, RT. TURN PULLUP- 119 KIAS	-2158.	7314.
84.	DIVE, LT. TURN PULLUP- 119 KIAS	-5215.	6894.
85.	DIVE, RT. TURN PULLUP- 136 KIAS	-239.	7913.
86.	DIVE, LT. TURN PULLUP- 136 KIAS	-5995.	6954.
87.	DIVE, PULLUP - 119 KIAS	-4496.	6654.
88.	CLIMB, MAX. RATE, PUSHOVER- 70	-3046.	2559.
89.	CLIMB, MAX. RATE, PUSHOVER- 136	-1439.	3237.
90.	CLIMB, MAX. RATE, PUSHOVER- 65	-3357.	1319.
91.	QUICK STOP - 136 KIAS TO HOVER.	-2038.	7554.

TABLE E-4 - Continued

PARAMETER M.R. HUB CHORD BENDING @ STA. 5.8 UNITS IN-LB ENDURANCE LIMIT 71549. STATIC LIMITS +-441000.
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR		
2.	NORMAL SHUTDOWN 100-0%		
3.	NORMAL TAKEOFF		
4.	JUMP TAKEOFF	120016.	47580.
5.	HOVER IGE 324 RPM	104915.	13378.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	106733.	16257.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	97544.	19792.
8.	HOVER, F/A REVERSAL	110074.	53262.
9.	HOVER, LAT. REVERSAL	112204.	45450.
10.	HOVER, DIR. REVERSAL	109364.	26986.
11.	SIDEWARD FLIGHT - RIGHT	84508.	54681.
12.	SIDEWARD FLIGHT - LEFT	103682.	35507.
13.	REARWARD FLIGHT	97291.	30536.
14.	LEVEL FLIGHT - 70 KIAS	70576.	23060.
15.	LEVEL FLIGHT - 85 KIAS	71343.	26579.
16.	LEVEL FLIGHT - 102 KIAS	96431.	26553.
17.	LEVEL FLIGHT - 119 KIAS	102972.	37638.
18.	LEVEL FLIGHT - 127 KIAS	115045.	45450.
19.	LEVEL FLIGHT - 136 KIAS	125218.	51643.
20.	CLIMB, 500 FPM - 70 KIAS	90129.	25349.
21.	CLIMB, 1000 FPM - 70 KIAS	103419.	25156.
22.	CLIMB, 1500 FPM - 70 KIAS	120726.	31247.
23.	CLIMB, 500 FPM - 85 KIAS	85929.	29116.
24.	CLIMB, 1000 FPM - 85 KIAS	101872.	29713.
25.	CLIMB, 1500 FPM - 85 KIAS	124500.	34972.
26.	CLIMB, 500 FPM - 105 KIAS	108947.	29713.
27.	CLIMB, 1000 FPM - 105 KIAS ...	123101.	39169.
28.	CLIMB, 500 FPM - 119 KIAS	121703.	36371.
29.	CLIMB, MAX.RATE - 70 KIAS	144872.	45450.
30.	CLIMB, MAX.RATE - 105 KIAS ...	149408.	49332.
31.	CLIMB, MAX.RATE - 119 KIAS ...	150817.	54970.
32.	CLIMB, MAX.RATE - 136 KIAS ...	144474.	58494.
33.	LEFT TURN, 70 KIAS	50312.	47517.
34.	LEFT TURN, 85 KIAS	56812.	46870.
35.	LEFT TURN, 105 KIAS	64132.	58494.
36.	LEFT TURN, 119 KIAS	97291.	64624.
37.	LEFT TURN, 127 KIAS	126855.	63427.
38.	LEFT TURN, 136 KIAS	113625.	80958.
39.	RIGHT TURN, 70 KIAS	90900.	61073.
40.	RIGHT TURN, 85 KIAS	100132.	67465.
41.	RIGHT TURN, 105 KIAS	69770.	59904.
42.	RIGHT TURN, 119 KIAS	97960.	68361.
43.	RIGHT TURN, 127 KIAS	119103.	75408.
44.	RIGHT TURN, 136 KIAS	135691.	86731.
45.	TURN REVERSAL, MILD - 70 KIAS .	75276.	38348.
46.	TURN REVERSAL, MILD - 85 KIAS .	73856.	46870.
47.	TURN REVERSAL, MILD - 105 KIAS	95846.	70475.
48.	TURN REVERSAL, MILD - 119 KIAS	113625.	69595.
49.	TURN REVERSAL, MILD - 136 KIAS	131084.	87389.
50.	TURN REVERSAL, MOD. - 105 KIAS	100842.	65334.

NO.	TEST CONDITION	MEAN.	OSC.
51.	TURN REVERSAL, MOD. - 136 KIAS	142031.	115045.
52.	F/A CONT. REVERSAL - 119 KIAS	103994.	45984.
53.	LAT. CONT. REVERSAL- 119 KIAS	122388.	65792.
54.	DIR. CONT. REVERSAL - 119 KIAS	104702.	41032.
55.	PULLUP, LEVEL FLIGHT - 70 KIAS	58943.	40479.
56.	PULLUP, LEVEL FLIGHT - 85 KIAS	71016.	44030.
57.	PULLUP, LEVEL FLIGHT- 105 KIAS	91968.	48106.
58.	PULLUP, LEVEL FLIGHT- 119 KIAS	109941.	62018.
59.	PULLUP, LEVEL FLIGHT- 127 KIAS	100132.	53262.
60.	PULLUP, DIVE - 136 KIAS	56102.	33377.
61.	AUTOROTATION ENTRY - 70 KIAS ..	54922.	15491.
62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	18168.
63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	19566.
64.	STAB. AUTO, 324 RPM - 105 KIAS	1420.	17044.
65.	STAB. AUTO, 294 RPM - 85 KIAS .	5681.	21304.
66.	STAB. AUTO, 339 RPM - 85 KIAS .	-9942.	19884.
67.	AUTO TURN, RIGHT - 70 KIAS	2795.	22360.
68.	AUTO TURN, LEFT - 70 KIAS	1398.	19566.
69.	AUTO PWR. RECOVERY	34240.	46818.
70.	APPROACH AND FLARE TO HOVER ...	88046.	60095.
71.	LEFT SIDESLIP - 70 KIAS	65685.	18168.
72.	LEFT SIDESLIP - 85 KIAS	57354.	27978.
73.	LEFT SIDESLIP - 136 KIAS	133509.	46870.
74.	RIGHT SIDESLIP - 70 KIAS	69878.	22361.
75.	RIGHT SIDESLIP - 85 KIAS	66447.	27278.
76.	RIGHT SIDESLIP - 136 KIAS	134929.	51131.
77.	DIVE, STEADY - 119 KIAS	59653.	15623.
78.	DIVE, STEADY - 136 KIAS	59653.	15623.
79.	DIVE, RIGHT TURN - 119 KIAS ...	52551.	29826.
80.	DIVE, LEFT TURN - 119 KIAS	63913.	19884.
81.	DIVE, RIGHT TURN - 136 KIAS ...	61073.	19884.
82.	DIVE, LEFT TURN - 136 KIAS	55392.	25565.
83.	DIVE, RT. TURN PULLUP- 119 KIAS	54681.	37638.
84.	DIVE, LT. TURN PULLUP- 119 KIAS	53971.	36928.
85.	DIVE, RT. TURN PULLUP- 136 KIAS	53971.	41189.
86.	DIVE, LT. TURN PULLUP- 136 KIAS	42069.	39768.
87.	DIVE, PULLUP - 119 KIAS	53561.	36647.
88.	CLIMB, MAX. RATE, PUSHOVER- 70	114335.	40479.
89.	CLIMB, MAX. RATE, PUSHOVER- 136	126855.	64837.
90.	CLIMB, MAX. RATE, PUSHOVER- 65	124987.	38348.
91.	QUICK STOP - 136 KIAS TO HOVER.	92320.	55392.

TABLE E-4 - Continued

PARAMETER M.R. BLADE CHORD BENDING @ STA.85 UNITS IN-LB ENDURANCE LIMIT 68170. STATIC LIMITS +-428000.
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR			51.	TURN REVERSAL, MOD. - 136 KIAS	98902.	85635.
2.	NORMAL SHUTDOWN 100-0%			52.	F/A CONT. REVERSAL - 119 KIAS	111566.	51260.
3.	NORMAL TAKEOFF			53.	LAT. CONT. REVERSAL- 119 KIAS	111566.	48848.
4.	JUMP TAKEOFF	107345.	36184.	54.	DIR. CONT. REVERSAL - 119 KIAS	108551.	30153.
5.	HOVER IGE 324 RPM	107014.	14781.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	92268.	41611.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	106282.	15524.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	97093.	51200.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	107476.	15524.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	163429.	41611.
8.	HOVER, F/A REVERSAL	108551.	36184.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	100711.	64527.
9.	HOVER, LAT. REVERSAL	112772.	25932.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	97696.	50657.
10.	HOVER, DIR. REVERSAL	112772.	15077.	60.	PULLUP, DIVE - 136 KIAS	85031.	34374.
11.	SIDEWARD FLIGHT - RIGHT	92268.	45230.	61.	AUTOROTATION ENTRY - 70 KIAS ..	97093.	13870.
12.	SIDEWARD FLIGHT - LEFT	96490.	28947.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	76428.	10748.
13.	REARWARD FLIGHT	101314.	28974.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	74039.	15524.
14.	LEVEL FLIGHT - 70 KIAS	97093.	18695.	64.	STAB. AUTO, 324 RPM - 105 KIAS	71161.	18092.
15.	LEVEL FLIGHT - 85 KIAS	97923.	31049.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	63321.	15077.
16.	LEVEL FLIGHT - 102 KIAS	99117.	29855.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	82619.	19901.
17.	LEVEL FLIGHT - 119 KIAS	107948.	25932.	67.	AUTO TURN, RIGHT - 70 KIAS	77025.	17316.
18.	LEVEL FLIGHT - 127 KIAS	110963.	26535.	68.	AUTO TURN, LEFT - 70 KIAS	76482.	14330.
19.	LEVEL FLIGHT - 136 KIAS	110360.	31962.	69.	AUTO PWR. RECOVERY	83593.	50156.
20.	CLIMB, 500 FPM - 70 KIAS	110360.	22313.	70.	APPROACH AND FLARE TO HOVER ...	97326.	48364.
21.	CLIMB, 1000 FPM - 70 KIAS	103297.	19704.	71.	LEFT SIDESLIP - 70 KIAS	99714.	17316.
22.	CLIMB, 1500 FPM - 70 KIAS	106139.	25329.	72.	LEFT SIDESLIP - 85 KIAS	97093.	29550.
23.	CLIMB, 500 FPM - 85 KIAS	104329.	33168.	73.	LEFT SIDESLIP - 136 KIAS	114581.	27741.
24.	CLIMB, 1000 FPM - 85 KIAS	107345.	28947.	74.	RIGHT SIDESLIP - 70 KIAS	100311.	21495.
25.	CLIMB, 1500 FPM - 85 KIAS	113978.	31962.	75.	RIGHT SIDESLIP - 85 KIAS	98920.	26535.
26.	CLIMB, 500 FPM - 105 KIAS	111566.	24725.	76.	RIGHT SIDESLIP - 136 KIAS	113375.	31359.
27.	CLIMB, 1000 FPM - 105 KIAS	112169.	31359.	77.	DIVE, STEADY - 119 KIAS	95283.	15680.
28.	CLIMB, 500 FPM - 119 KIAS	108551.	25329.	78.	DIVE, STEADY - 136 KIAS	92268.	13870.
29.	CLIMB, MAX.RATE - 70 KIAS	117597.	30756.	79.	DIVE, RIGHT TURN - 119 KIAS ...	87444.	35581.
30.	CLIMB, MAX.RATE - 105 KIAS	120612.	33771.	80.	DIVE, LEFT TURN - 119 KIAS	91602.	23519.
31.	CLIMB, MAX.RATE - 119 KIAS	115184.	35580.	81.	DIVE, RIGHT TURN - 136 KIAS ...	91665.	26535.
32.	CLIMB, MAX.RATE - 136 KIAS	123024.	38595.	82.	DIVE, LEFT TURN - 136 KIAS ...	89253.	33771.
33.	LEFT TURN, 70 KIAS	91665.	32565.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	80810.	45832.
34.	LEFT TURN, 85 KIAS	80810.	50657.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	78397.	42214.
35.	LEFT TURN, 105 KIAS	100108.	63924.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	80810.	44626.
36.	LEFT TURN, 119 KIAS	97696.	66337.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	80810.	45832.
37.	LEFT TURN, 127 KIAS	107344.	47033.	87.	DIVE, PULLUP - 119 KIAS	86840.	50657.
38.	LEFT TURN, 136 KIAS	104932.	71161.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	102520.	26535.
39.	RIGHT TURN, 70 KIAS	94077.	65130.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	115184.	39199.
40.	RIGHT TURN, 85 KIAS	97696.	73573.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	117597.	25932.
41.	RIGHT TURN, 105 KIAS	86840.	63924.	91.	QUICK STOP - 136 KIAS TO HOVER.	96490.	43420.
42.	RIGHT TURN, 119 KIAS	89252.	59099.				
43.	RIGHT TURN, 127 KIAS	101917.	62115.				
44.	RIGHT TURN, 136 KIAS	106139.	55482.				
45.	TURN REVERSAL, MILD - 70 KIAS .	91665.	42214.				
46.	TURN REVERSAL, MILD - 85 KIAS .	93474.	51260.				
47.	TURN REVERSAL, MILD - 105 KIAS	93474.	68145.				
48.	TURN REVERSAL, MILD - 119 KIAS	98920.	59100.				
49.	TURN REVERSAL, MILD - 136 KIAS	106741.	56084.				
50.	TURN REVERSAL, MOD. - 105 KIAS	90459.	67543.				

TABLE E-4 - Continued

PARAMETER M.R. BLADE CHORD BENDING @ STA.180 UNITS IN-LB ENDURANCE LIMIT 39400. STATIC LIMITS +-110000.
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR			51.	TURN REVERSAL, MOD. - 136 KIAS	8785.	37234.
2.	NORMAL SHUTDOWN 100-0%			52.	F/A CONT. REVERSAL - 119 KIAS	11182.	12010.
3.	NORMAL TAKEOFF			53.	LAT. CONT. REVERSAL- 119 KIAS	14495.	21121.
4.	JUMP TAKEOFF	10877.	14224.	54.	DIR. CONT. REVERSAL - 119 KIAS	14909.	12424.
5.	HOVER IGE 324 RPM	9742.	6495.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	9111.	17393.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	12584.	7713.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	9111.	30646.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	11366.	8930.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	7454.	25676.
8.	HOVER, F/A REVERSAL	12010.	14495.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	9839.	27879.
9.	HOVER, LAT. REVERSAL	12838.	12838.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	11182.	24434.
10.	HOVER, DIR. REVERSAL	14080.	6626.	60.	PULLUP, DIVE - 136 KIAS	5020.	17571.
11.	SIDEWARD FLIGHT - RIGHT	6626.	18221.	61.	AUTOROTATION ENTRY - 70 KIAS ..	4602.	7112.
12.	SIDEWARD FLIGHT - LEFT	8697.	12838.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	2460.	5740.
13.	REARWARD FLIGHT	7868.	15322.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	2870.	6150.
14.	LEVEL FLIGHT - 70 KIAS	9111.	9939.	64.	STAB. AUTO, 324 RPM - 105 KIAS	3727.	9525.
15.	LEVEL FLIGHT - 85 KIAS	17393.	19050.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	3313.	6626.
16.	LEVEL FLIGHT - 102 KIAS	16565.	14909.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	7454.	11596.
17.	LEVEL FLIGHT - 119 KIAS	15323.	12010.	67.	AUTO TURN, RIGHT - 70 KIAS	2460.	6560.
18.	LEVEL FLIGHT - 127 KIAS	13666.	12010.	68.	AUTO TURN, LEFT - 70 KIAS	2870.	6150.
19.	LEVEL FLIGHT - 136 KIAS	13666.	12838.	69.	AUTO PWR. RECOVERY	2870.	24189.
20.	CLIMB, 500 FPM - 70 KIAS	12132.	10459.	70.	APPROACH AND FLARE TO HOVER ...	10250.	27469.
21.	CLIMB, 1000 FPM - 70 KIAS	9430.	9430.	71.	LEFT SIDESLIP - 70 KIAS	7380.	9840.
22.	CLIMB, 1500 FPM - 70 KIAS	9939.	10767.	72.	LEFT SIDESLIP - 85 KIAS	15990.	15170.
23.	CLIMB, 500 FPM - 85 KIAS	12010.	16151.	73.	LEFT SIDESLIP - 136 KIAS	13530.	12710.
24.	CLIMB, 1000 FPM - 85 KIAS	13252.	14909.	74.	RIGHT SIDESLIP - 70 KIAS	9020.	11480.
25.	CLIMB, 1500 FPM - 85 KIAS	12710.	12710.	75.	RIGHT SIDESLIP - 85 KIAS	14760.	14760.
26.	CLIMB, 500 FPM - 105 KIAS	13666.	12010.	76.	RIGHT SIDESLIP - 136 KIAS	12969.	12969.
27.	CLIMB, 1000 FPM - 105 KIAS	11070.	13530.	77.	DIVE, STEADY - 119 KIAS	11296.	10459.
28.	CLIMB, 500 FPM - 119 KIAS	12300.	11480.	78.	DIVE, STEADY - 136 KIAS	9840.	9840.
29.	CLIMB, MAX.RATE - 70 KIAS	16151.	11182.	79.	DIVE, RIGHT TURN - 119 KIAS ...	8367.	20081.
30.	CLIMB, MAX.RATE - 105 KIAS	13939.	13119.	80.	DIVE, LEFT TURN - 119 KIAS	7948.	15479.
31.	CLIMB, MAX.RATE - 119 KIAS	13119.	13939.	81.	DIVE, RIGHT TURN - 136 KIAS ...	5857.	17571.
32.	CLIMB, MAX.RATE - 136 KIAS	14349.	15989.	82.	DIVE, LEFT TURN - 136 KIAS ...	6275.	20499.
33.	LEFT TURN, 70 KIAS	8283.	17393.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	1656.	21534.
34.	LEFT TURN, 85 KIAS	4920.	24600.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	1242.	21120.
35.	LEFT TURN, 105 KIAS	7380.	27879.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	4555.	21120.
36.	LEFT TURN, 119 KIAS	6694.	28449.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	4555.	21120.
37.	LEFT TURN, 127 KIAS	15169.	22549.	87.	DIVE, PULLUP - 119 KIAS	6559.	32799.
38.	LEFT TURN, 136 KIAS	15737.	30646.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	11596.	9939.
39.	RIGHT TURN, 70 KIAS	10353.	31888.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	15990.	15990.
40.	RIGHT TURN, 85 KIAS	10353.	38514.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	12969.	10459.
41.	RIGHT TURN, 105 KIAS	9019.	29519.	91.	QUICK STOP - 136 KIAS TO HOVER.	6694.	20918.
42.	RIGHT TURN, 119 KIAS	11889.	25009.				
43.	RIGHT TURN, 127 KIAS	11479.	29519.				
44.	RIGHT TURN, 136 KIAS	13530.	23369.				
45.	TURN REVERSAL, MILD - 70 KIAS .	9111.	21535.				
46.	TURN REVERSAL, MILD - 85 KIAS .	9111.	30646.				
47.	TURN REVERSAL, MILD - 105 KIAS	7789.	36489.				
48.	TURN REVERSAL, MILD - 119 KIAS	11182.	30231.				
49.	TURN REVERSAL, MILD - 136 KIAS	13530.	25009.				
50.	TURN REVERSAL, MOD. - 105 KIAS	5439.	34723.				

TABLE E-4 - Continued

PARAMETER M.R. BLADE TORSION BENDING @ STA.85 UNITS IN-LB ENDURANCE LIMIT 15580. STATIC LIMITS +-27720.
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR			51.	TURN REVERSAL, MOD. - 136 KIAS	-1330.	8783.
2.	NORMAL SHUTDOWN 100-0%			52.	F/A CONT. REVERSAL - 119 KIAS	-1560.	6066.
3.	NORMAL TAKEOFF			53.	LAT. CONT. REVERSAL- 119 KIAS	-1300.	6153.
4.	JUMP TAKEOFF	-266.	2040.	54.	DIR. CONT. REVERSAL - 119 KIAS	-1127.	5459.
5.	HOVER IGE 324 RPM	-347.	1040.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	248.	3064.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	240.	1683.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	921.	4940.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	1282.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	-693.	5893.
8.	HOVER, F/A REVERSAL	-166.	2650.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	-1370.	6681.
9.	HOVER, LAT. REVERSAL	828.	2484.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	-891.	6885.
10.	HOVER, DIR. REVERSAL	0.	994.	60.	PULLUP, DIVE - 136 KIAS	-354.	7097.
11.	SIDEWARD FLIGHT - RIGHT	655.	3112.	61.	AUTOROTATION ENTRY - 70 KIAS ..	508.	2033.
12.	SIDEWARD FLIGHT - LEFT	-173.	2253.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	2056.	2227.
13.	REARWARD FLIGHT	164.	1802.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	1628.	2998.
14.	LEVEL FLIGHT - 70 KIAS	433.	2513.	64.	STAB. AUTO, 324 RPM - 105 KIAS	1005.	3349.
15.	LEVEL FLIGHT - 85 KIAS	867.	3640.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	1325.	2815.
16.	LEVEL FLIGHT - 102 KIAS	-1114.	4540.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	2567.	3064.
17.	LEVEL FLIGHT - 119 KIAS	-1242.	5548.	67.	AUTO TURN, RIGHT - 70 KIAS	2056.	2741.
18.	LEVEL FLIGHT - 127 KIAS	-2177.	6029.	68.	AUTO TURN, LEFT - 70 KIAS	2056.	1885.
19.	LEVEL FLIGHT - 136 KIAS	-2080.	6066.	69.	AUTO PWR. RECOVERY	514.	4968.
20.	CLIMB, 500 FPM - 70 KIAS	-85.	2794.	70.	APPROACH AND FLARE TO HOVER ...	257.	3512.
21.	CLIMB, 1000 FPM - 70 KIAS	-1028.	2570.	71.	LEFT SIDESLIP - 70 KIAS	600.	2142.
22.	CLIMB, 1500 FPM - 70 KIAS	-1573.	3064.	72.	LEFT SIDESLIP - 85 KIAS	2025.	2997.
23.	CLIMB, 500 FPM - 85 KIAS	-419.	3768.	73.	LEFT SIDESLIP - 136 KIAS	-2484.	6387.
24.	CLIMB, 1000 FPM - 85 KIAS	-1300.	3553.	74.	RIGHT SIDESLIP - 70 KIAS	514.	2570.
25.	CLIMB, 1500 FPM - 85 KIAS	-1215.	3645.	75.	RIGHT SIDESLIP - 85 KIAS	810.	4050.
26.	CLIMB, 500 FPM - 105 KIAS	-1560.	4159.	76.	RIGHT SIDESLIP - 136 KIAS	-2395.	6476.
27.	CLIMB, 1000 FPM - 105 KIAS	-1458.	4536.	77.	DIVE, STEADY - 119 KIAS	-798.	5411.
28.	CLIMB, 500 FPM - 119 KIAS	-1782.	5184.	78.	DIVE, STEADY - 136 KIAS	-887.	6032.
29.	CLIMB, MAX.RATE - 70 KIAS	-1458.	3402.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	5855.
30.	CLIMB, MAX.RATE - 105 KIAS	-1798.	4539.	80.	DIVE, LEFT TURN - 119 KIAS	-443.	5057.
31.	CLIMB, MAX.RATE - 119 KIAS	-2227.	5310.	81.	DIVE, RIGHT TURN - 136 KIAS ...	-266.	6831.
32.	CLIMB, MAX.RATE - 136 KIAS	-2398.	5996.	82.	DIVE, LEFT TURN - 136 KIAS ...	-177.	6742.
33.	LEFT TURN, 70 KIAS	-857.	4283.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	573.	4997.
34.	LEFT TURN, 85 KIAS	-921.	4940.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	-655.	5896.
35.	LEFT TURN, 105 KIAS	-1296.	7452.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	409.	7943.
36.	LEFT TURN, 119 KIAS	-887.	7097.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	7042.
37.	LEFT TURN, 127 KIAS	-428.	6938.	87.	DIVE, PULLUP - 119 KIAS	972.	5994.
38.	LEFT TURN, 136 KIAS	-1296.	9397.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	-1053.	3159.
39.	RIGHT TURN, 70 KIAS	754.	5108.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	-2106.	5832.
40.	RIGHT TURN, 85 KIAS	972.	6318.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	-621.	2572.
41.	RIGHT TURN, 105 KIAS	0.	7290.	91.	QUICK STOP - 136 KIAS TO HOVER.	-709.	5323.
42.	RIGHT TURN, 119 KIAS	-486.	7938.				
43.	RIGHT TURN, 127 KIAS	-770.	7452.				
44.	RIGHT TURN, 136 KIAS	-486.	7614.				
45.	TURN REVERSAL, MILD - 70 KIAS .	1905.	3892.				
46.	TURN REVERSAL, MILD - 85 KIAS .	251.	5778.				
47.	TURN REVERSAL, MILD - 105 KIAS	1627.	6424.				
48.	TURN REVERSAL, MILD - 119 KIAS	-162.	8587.				
49.	TURN REVERSAL, MILD - 136 KIAS	-1539.	8181.				
50.	TURN REVERSAL, MOD. - 105 KIAS	798.	7383.				

TABLE E-4 - Continued

PARAMETER M.R. BLADE TORSION BENDING @ STA.180 UNITS IN-LB ENDURANCE LIMIT 11800. STATIC LIMITS
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR			51.	TURN REVERSAL, MOD. - 136 KIAS	-1364.	5815.
2.	NORMAL SHUTDOWN 100-0%			52.	F/A CONT. REVERSAL - 119 KIAS	-790.	4093.
3.	NORMAL TAKEOFF			53.	LAT. CONT. REVERSAL- 119 KIAS	-503.	4380.
4.	JUMP TAKEOFF	72.	1364.	54.	DIR. CONT. REVERSAL - 119 KIAS	-287.	3734.
5.	HOVER IGE 324 RPM	139.	696.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	790.	2800.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	281.	1266.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	1149.	3590.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	492.	915.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	-503.	4380.
8.	HOVER, F/A REVERSAL	287.	2010.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	-284.	5258.
9.	HOVER, LAT. REVERSAL	646.	1795.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	-290.	5368.
10.	HOVER, DIR. REVERSAL	503.	933.	60.	PULLUP, DIVE - 136 KIAS	-430.	4738.
11.	SIDEWARD FLIGHT - RIGHT	287.	2154.	61.	AUTOROTATION ENTRY - 70 KIAS ..	943.	1959.
12.	SIDEWARD FLIGHT - LEFT	72.	1507.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	1651.	1651.
13.	REARWARD FLIGHT	215.	1508.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	1364.	2226.
14.	LEVEL FLIGHT - 70 KIAS	1292.	2585.	64.	STAB. AUTO, 324 RPM - 105 KIAS		
15.	LEVEL FLIGHT - 85 KIAS	1651.	3231.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	933.	2226.
16.	LEVEL FLIGHT - 102 KIAS	862.	3446.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	2154.	2298.
17.	LEVEL FLIGHT - 119 KIAS	215.	3805.	67.	AUTO TURN, RIGHT - 70 KIAS	1508.	2369.
18.	LEVEL FLIGHT - 127 KIAS	-1005.	3877.	68.	AUTO TURN, LEFT - 70 KIAS	1795.	1651.
19.	LEVEL FLIGHT - 136 KIAS	-1295.	4308.	69.	AUTO PWR. RECOVERY	359.	3518.
20.	CLIMB, 500 FPM - 70 KIAS	653.	2829.	70.	APPROACH AND FLARE TO HOVER ...	359.	2226.
21.	CLIMB, 1000 FPM - 70 KIAS	-215.	2369.	71.	LEFT SIDESLIP - 70 KIAS	718.	2010.
22.	CLIMB, 1500 FPM - 70 KIAS	-790.	2513.	72.	LEFT SIDESLIP - 85 KIAS	2040.	2744.
23.	CLIMB, 500 FPM - 85 KIAS			73.	LEFT SIDESLIP - 136 KIAS	-1148.	4308.
24.	CLIMB, 1000 FPM - 85 KIAS	-215.	2944.	74.	RIGHT SIDESLIP - 70 KIAS	1221.	2369.
25.	CLIMB, 1500 FPM - 85 KIAS	-352.	2884.	75.	RIGHT SIDESLIP - 85 KIAS	1196.	3025.
26.	CLIMB, 500 FPM - 105 KIAS	-503.	3087.	76.	RIGHT SIDESLIP - 136 KIAS	-1220.	4380.
27.	CLIMB, 1000 FPM - 105 KIAS	-562.	3377.	77.	DIVE, STEADY - 119 KIAS	359.	3518.
28.	CLIMB, 500 FPM - 119 KIAS	-1055.	3729.	78.	DIVE, STEADY - 136 KIAS	-143.	4020.
29.	CLIMB, MAX.RATE - 70 KIAS	-290.	2612.	79.	DIVE, RIGHT TURN - 119 KIAS ...	215.	4092.
30.	CLIMB, MAX.RATE - 105 KIAS	-497.	3482.	80.	DIVE, LEFT TURN - 119 KIAS	215.	3518.
31.	CLIMB, MAX.RATE - 119 KIAS	-994.	3979.	81.	DIVE, RIGHT TURN - 136 KIAS ...	-359.	4523.
32.	CLIMB, MAX.RATE - 136 KIAS	-1137.	4406.	82.	DIVE, LEFT TURN - 136 KIAS ...	-144.	4595.
33.	LEFT TURN, 70 KIAS	574.	3016.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	-287.	3590.
34.	LEFT TURN, 85 KIAS	798.	3555.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	-431.	4020.
35.	LEFT TURN, 05 KIAS	-789.	4810.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	-287.	5313.
36.	LEFT TURN, .19 KIAS	-2225.	7251.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	-143.	4882.
37.	LEFT TURN, 127 KIAS	-213.	5045.	87.	DIVE, PULLUP - 119 KIAS	287.	4020.
38.	LEFT TURN, 136 KIAS	145.	5949.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	-145.	2467.
39.	RIGHT TURN, 70 KIAS	933.	3375.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	-215.	4379.
40.	RIGHT TURN, 85 KIAS	933.	5097.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	144.	2154.
41.	RIGHT TURN, 105 KIAS	287.	5887.	91.	QUICK STOP - 136 KIAS TO HOVER.	-143.	3877.
42.	RIGHT TURN, 119 KIAS	-574.	5600.				
43.	RIGHT TURN, 127 KIAS	-568.	4974.				
44.	RIGHT TURN, 136 KIAS	-1407.	5909.				
45.	TURN REVERSAL, MILD - 70 KIAS .	933.	3375.				
46.	TURN REVERSAL, MILD - 85 KIAS .						
47.	TURN REVERSAL, MILD - 105 KIAS	710.	5258.				
48.	TURN REVERSAL, MILD - 119 KIAS	-290.	5949.				
49.	TURN REVERSAL, MILD - 136 KIAS	-933.	5815.				
50.	TURN REVERSAL, MOD. - 105 KIAS	430.	5600.				

TABLE E-4 - Continued

PARAMETER PITCH LINK LOAD UNITS LB ENDURANCE LIMIT 1580. STATIC LIMITS +4400.,-2550.
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR			51.	TURN REVERSAL, MOD. - 136 KIAS	-15.	1624.
2.	NORMAL SHUTDOWN 100-0%			52.	F/A CONT. REVERSAL - 119 KIAS	29.	1100.
3.	NORMAL TAKEOFF			53.	LAT. CONT. REVERSAL- 119 KIAS	29.	1187.
4.	JUMP TAKEOFF	175.	644.	54.	DIR. CONT. REVERSAL - 119 KIAS	290.	1072.
5.	HOVER IGE 324 RPM	156.	355.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	-174.	608.
6.	HOVER TURN, RIGHT 30 DEG/SEC	143.	287.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	-88.	936.
7.	HOVER TURN, LEFT 30 DEG/SEC	29.	344.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	87.	1158.
8.	HOVER, F/A REVERSAL	43.	565.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	129.	1246.
9.	HOVER, LAT. REVERSAL	58.	608.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	146.	1229.
10.	HOVER, DIR. REVERSAL	188.	391.	60.	PULLUP, DIVE - 136 KIAS	-161.	1273.
11.	SIDEWARD FLIGHT - RIGHT	-87.	468.	61.	AUTOROTATION ENTRY - 70 KIAS	-304.	391.
12.	SIDEWARD FLIGHT - LEFT	-29.	555.	62.	STAB. AUTO, 324 RPM - 70 KIAS	-449.	333.
13.	REARWARD FLIGHT	102.	570.	63.	STAB. AUTO, 324 RPM - 85 KIAS	-521.	376.
14.	LEVEL FLIGHT - 70 KIAS	-72.	565.	64.	STAB. AUTO, 324 RPM - 105 KIAS	-395.	688.
15.	LEVEL FLIGHT - 85 KIAS	376.	753.	65.	STAB. AUTO, 294 RPM - 85 KIAS	-188.	536.
16.	LEVEL FLIGHT - 102 KIAS	362.	912.	66.	STAB. AUTO, 339 RPM - 85 KIAS	-376.	348.
17.	LEVEL FLIGHT - 119 KIAS	72.	1103.	67.	AUTO TURN, RIGHT - 70 KIAS	-623.	449.
18.	LEVEL FLIGHT - 127 KIAS	293.	1141.	68.	AUTO TURN, LEFT - 70 KIAS	-536.	420.
19.	LEVEL FLIGHT - 136 KIAS	347.	1187.	69.	AUTO PWR. RECOVERY	-72.	1028.
20.	CLIMB, 500 FPM - 70 KIAS	130.	594.	70.	APPROACH AND FLARE TO HOVER	-217.	710.
21.	CLIMB, 1000 FPM - 70 KIAS	188.	565.	71.	LEFT SIDESLIP - 70 KIAS	-145.	521.
22.	CLIMB, 1500 FPM - 70 KIAS	232.	608.	72.	LEFT SIDESLIP - 85 KIAS	215.	674.
23.	CLIMB, 500 FPM - 85 KIAS	190.	746.	73.	LEFT SIDESLIP - 136 KIAS	300.	1247.
24.	CLIMB, 1000 FPM - 85 KIAS	290.	724.	74.	RIGHT SIDESLIP - 70 KIAS	29.	521.
25.	CLIMB, 1500 FPM - 85 KIAS	301.	702.	75.	RIGHT SIDESLIP - 85 KIAS	315.	802.
26.	CLIMB, 500 FPM - 105 KIAS	348.	782.	76.	RIGHT SIDESLIP - 136 KIAS	322.	1258.
27.	CLIMB, 1000 FPM - 105 KIAS	287.	860.	77.	DIVE, STEADY - 119 KIAS	88.	1112.
28.	CLIMB, 500 FPM - 119 KIAS	201.	1060.	78.	DIVE, STEADY - 136 KIAS	0.	1141.
29.	CLIMB, MAX.RATE - 70 KIAS	439.	644.	79.	DIVE, RIGHT TURN - 119 KIAS	59.	1112.
30.	CLIMB, MAX.RATE - 105 KIAS	515.	773.	80.	DIVE, LEFT TURN - 119 KIAS	-44.	1068.
31.	CLIMB, MAX.RATE - 119 KIAS	487.	974.	81.	DIVE, RIGHT TURN - 136 KIAS	0.	1170.
32.	CLIMB, MAX.RATE - 136 KIAS	506.	1086.	82.	DIVE, LEFT TURN - 136 KIAS	-15.	1185.
33.	LEFT TURN, 70 KIAS	-159.	796.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	-293.	1170.
34.	LEFT TURN, 85 KIAS	-275.	796.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	-175.	1345.
35.	LEFT TURN, 105 KIAS	159.	1607.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	-277.	1536.
36.	LEFT TURN, 119 KIAS	102.	1478.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	-102.	1448.
37.	LEFT TURN, 127 KIAS	14.	1275.	87.	DIVE, PULLUP - 119 KIAS	-43.	1317.
38.	LEFT TURN, 136 KIAS	439.	1551.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	410.	585.
39.	RIGHT TURN, 70 KIAS	-410.	1083.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	695.	1071.
40.	RIGHT TURN, 85 KIAS	-188.	1375.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	424.	512.
41.	RIGHT TURN, 105 KIAS	130.	1491.	91.	QUICK STOP - 136 KIAS TO HOVER.	-73.	1156.
42.	RIGHT TURN, 119 KIAS	188.	1520.				
43.	RIGHT TURN, 127 KIAS	229.	375.				
44.	RIGHT TURN, 136 KIAS	14.	1419.				
45.	TURN REVERSAL, MILD - 70 KIAS	-290.	869.				
46.	TURN REVERSAL, MILD - 85 KIAS	-234.	1053.				
47.	TURN REVERSAL, MILD - 105 KIAS	129.	1447.				
48.	TURN REVERSAL, MILD - 119 KIAS	102.	1448.				
49.	TURN REVERSAL, MILD - 136 KIAS	72.	1375.				
50.	TURN REVERSAL, MOD. - 105 KIAS	-88.	1424.				

TABLE E-4 - Continued

PARAMETER M.R. BLADE DRAG BRACE LOAD UNITS LB ENDURANCE LIMIT 5920. STATIC LIMITS +20518,-14189.
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR		
2.	NORMAL SHUTDOWN 100-0%		
3.	NORMAL TAKEOFF		
4.	JUMP TAKEOFF	8019.	2455.
5.	HOVER IGE 324 RPM	8112.	937.
6.	HOVER TURN, RIGHT 30 DEG/SEC	7777.	941.
7.	HOVER TURN, LEFT 30 DEG/SEC	8625.	1009.
8.	HOVER, F/A REVERSAL	8152.	2422.
9.	HOVER, LAT. REVERSAL	8012.	1723.
10.	HOVER, DIR. REVERSAL	7919.	978.
11.	SIDEWARD FLIGHT - RIGHT	9011.	3004.
12.	SIDEWARD FLIGHT - LEFT	8522.	1677.
13.	REARWARD FLIGHT	8406.	2026.
14.	LEVEL FLIGHT - 70 KIAS	9036.	1211.
15.	LEVEL FLIGHT - 85 KIAS	9013.	1747.
16.	LEVEL FLIGHT - 102 KIAS	8757.	1584.
17.	LEVEL FLIGHT - 119 KIAS	8082.	1700.
18.	LEVEL FLIGHT - 127 KIAS	7686.	1956.
19.	LEVEL FLIGHT - 136 KIAS	7639.	2422.
20.	CLIMB, 500 FPM - 70 KIAS	8827.	1095.
21.	CLIMB, 1000 FPM - 70 KIAS	8050.	1276.
22.	CLIMB, 1500 FPM - 70 KIAS	7802.	1607.
23.	CLIMB, 500 FPM - 85 KIAS	8408.	1840.
24.	CLIMB, 1000 FPM - 85 KIAS	8035.	1700.
25.	CLIMB, 1500 FPM - 85 KIAS	7696.	2057.
26.	CLIMB, 500 FPM - 105 KIAS	7998.	1560.
27.	CLIMB, 1000 FPM - 105 KIAS	7696.	2011.
28.	CLIMB, 500 FPM - 119 KIAS	7834.	1733.
29.	CLIMB, MAX.RATE - 70 KIAS	6800.	2096.
30.	CLIMB, MAX.RATE - 105 KIAS	7006.	2413.
31.	CLIMB, MAX.RATE - 119 KIAS	7099.	2598.
32.	CLIMB, MAX.RATE - 136 KIAS	7030.	2761.
33.	LEFT TURN, 70 KIAS	10672.	1717.
34.	LEFT TURN, 85 KIAS	9991.	2957.
35.	LEFT TURN, 105 KIAS	8873.	3563.
36.	LEFT TURN, 119 KIAS	9305.	3881.
37.	LEFT TURN, 127 KIAS	7958.	3132.
38.	LEFT TURN, 136 KIAS	8873.	4634.
39.	RIGHT TURN, 70 KIAS	8850.	3773.
40.	RIGHT TURN, 85 KIAS	8454.	4169.
41.	RIGHT TURN, 105 KIAS	9814.	3642.
42.	RIGHT TURN, 119 KIAS	9303.	3642.
43.	RIGHT TURN, 127 KIAS	8445.	4083.
44.	RIGHT TURN, 136 KIAS	7788.	4137.
45.	TURN REVERSAL, MILD - 70 KIAS	9572.	2306.
46.	TURN REVERSAL, MILD - 85 KIAS	9037.	2880.
47.	TURN REVERSAL, MILD - 105 KIAS	9141.	3898.
48.	TURN REVERSAL, MILD - 119 KIAS	8314.	3470.
49.	TURN REVERSAL, MILD - 136 KIAS	7702.	4083.
50.	TURN REVERSAL, MOD. - 105 KIAS	9001.	3998.
51.	TURN REVERSAL, MOD. - 136 KIAS	7856.	5845.
52.	F/A CONT. REVERSAL - 119 KIAS	7406.	3447.
53.	LAT. CONT. REVERSAL- 119 KIAS	7429.	3144.
54.	DIR. CONT. REVERSAL - 119 KIAS	8035.	1980.
55.	PULLUP, LEVEL FLIGHT - 70 KIAS	9712.	2585.
56.	PULLUP, LEVEL FLIGHT - 85 KIAS	9037.	2981.
57.	PULLUP, LEVEL FLIGHT- 105 KIAS	8757.	2795.
58.	PULLUP, LEVEL FLIGHT- 119 KIAS	8654.	3550.
59.	PULLUP, LEVEL FLIGHT- 127 KIAS	8943.	2934.
60.	PULLUP, DIVE - 136 KIAS	10077.	2128.
61.	AUTOROTATION ENTRY - 70 KIAS	9665.	815.
62.	STAB. AUTO, 324 RPM - 70 KIAS	10718.	835.
63.	STAB. AUTO, 324 RPM - 85 KIAS	10649.	1369.
64.	STAB. AUTO, 324 RPM - 105 KIAS	10317.	1188.
65.	STAB. AUTO, 294 RPM - 85 KIAS	9316.	1071.
66.	STAB. AUTO, 339 RPM - 85 KIAS	11692.	1211.
67.	AUTO TURN, RIGHT - 70 KIAS	11809.	1137.
68.	AUTO TURN, LEFT - 70 KIAS	11391.	998.
69.	AUTO PWR. RECOVERY	10626.	3109.
70.	APPROACH AND FLARE TO HOVER	8932.	2946.
71.	LEFT SIDESLIP - 70 KIAS	9187.	1021.
72.	LEFT SIDESLIP - 85 KIAS	9105.	1618.
73.	LEFT SIDESLIP - 136 KIAS	7388.	2151.
74.	RIGHT SIDESLIP - 70 KIAS	9002.	1346.
75.	RIGHT SIDESLIP - 85 KIAS	8828.	1710.
76.	RIGHT SIDESLIP - 136 KIAS	7552.	2361.
77.	DIVE, STEADY - 119 KIAS	9282.	912.
78.	DIVE, STEADY - 136 KIAS	9071.	888.
79.	DIVE, RIGHT TURN - 119 KIAS	10147.	2057.
80.	DIVE, LEFT TURN - 119 KIAS	9282.	1192.
81.	DIVE, RIGHT TURN - 136 KIAS	9586.	1403.
82.	DIVE, LEFT TURN - 136 KIAS	10124.	1847.
83.	DIVE, RT. TURN PULLUP- 119 KIAS	10408.	2538.
84.	DIVE, LT. TURN PULLUP- 119 KIAS	10897.	2514.
85.	DIVE, RT. TURN PULLUP- 136 KIAS	10361.	2724.
86.	DIVE, LT. TURN PULLUP- 136 KIAS	10617.	2561.
87.	DIVE, PULLUP - 119 KIAS	10393.	2598.
88.	CLIMB, MAX. RATE, PUSHOVER- 70	7220.	1677.
89.	CLIMB, MAX. RATE, PUSHOVER- 136	7285.	2923.
90.	CLIMB, MAX. RATE, PUSHOVER- 65	7645.	1847.
91.	QUICK STOP - 136 KIAS TO HOVER.	8861.	2595.

TABLE E-4 - Continued

PARAMETER M.R. MAST BENDING @ 0. DEG. UNITS IN-LB ENDURANCE LIMIT 22610. STATIC LIMITS
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR		
2.	NORMAL SHUTDOWN 100-0%		
3.	NORMAL TAKEOFF		
4.	JUMP TAKEOFF	302.	28737.
5.	HOVER IGE 324 RPM	-908.	19058.
6.	HOVER TURN, RIGHT 30 DEG/SEC	-3025.	18755.
7.	HOVER TURN, LEFT 30 DEG/SEC	-3025.	19360.
8.	HOVER, F/A REVERSAL	618.	30262.
9.	HOVER, LAT. REVERSAL	-309.	21925.
10.	HOVER, DIR. REVERSAL	-618.	22851.
11.	SIDEWARD FLIGHT - RIGHT	303.	25108.
12.	SIDEWARD FLIGHT - LEFT	1210.	21780.
13.	REARWARD FLIGHT	605.	26620.
14.	LEVEL FLIGHT - 70 KIAS	1210.	10890.
15.	LEVEL FLIGHT - 85 KIAS	-605.	9075.
16.	LEVEL FLIGHT - 102 KIAS	303.	8168.
17.	LEVEL FLIGHT - 119 KIAS	0.	7411.
18.	LEVEL FLIGHT - 127 KIAS	-908.	8168.
19.	LEVEL FLIGHT - 136 KIAS	-605.	8470.
20.	CLIMB, 500 FPM - 70 KIAS	-908.	8773.
21.	CLIMB, 1000 FPM - 70 KIAS	-605.	7865.
22.	CLIMB, 1500 FPM - 70 KIAS	0.	7411.
23.	CLIMB, 500 FPM - 85 KIAS	-605.	7865.
24.	CLIMB, 1000 FPM - 85 KIAS	-303.	8168.
25.	CLIMB, 1500 FPM - 85 KIAS	-303.	6958.
26.	CLIMB, 500 FPM - 105 KIAS	0.	6655.
27.	CLIMB, 1000 FPM - 105 KIAS	-605.	7260.
28.	CLIMB, 500 FPM - 119 KIAS	-303.	7563.
29.	CLIMB, MAX.RATE - 70 KIAS	-302.	8167.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	8470.
31.	CLIMB, MAX.RATE - 119 KIAS	-303.	8773.
32.	CLIMB, MAX.RATE - 136 KIAS	-605.	11495.
33.	LEFT TURN, 70 KIAS	-1210.	32065.
34.	LEFT TURN, 85 KIAS	-1513.	25713.
35.	LEFT TURN, 105 KIAS	-1210.	16940.
36.	LEFT TURN, 119 KIAS	-1815.	17454.
37.	LEFT TURN, 127 KIAS	-605.	13310.
38.	LEFT TURN, 136 KIAS	302.	14217.
39.	RIGHT TURN, 70 KIAS	-908.	22688.
40.	RIGHT TURN, 85 KIAS	-1210.	22385.
41.	RIGHT TURN, 105 KIAS	-1513.	15428.
42.	RIGHT TURN, 119 KIAS	-1513.	14218.
43.	RIGHT TURN, 127 KIAS	-1210.	10890.
44.	RIGHT TURN, 136 KIAS	-908.	12403.
45.	TURN REVERSAL, MILD - 70 KIAS	0.	15440.
46.	TURN REVERSAL, MILD - 85 KIAS	-605.	13310.
47.	TURN REVERSAL, MILD - 105 KIAS	-605.	16335.
48.	TURN REVERSAL, MILD - 119 KIAS	605.	10285.
49.	TURN REVERSAL, MILD - 136 KIAS	-1815.	14520.
50.	TURN REVERSAL, MOD. - 105 KIAS	-605.	12100.

NO.	TEST CONDITION	MEAN.	OSC.
51.	TURN REVERSAL, MOD. - 136 KIAS	-1512.	15427.
52.	F/A CONT. REVERSAL - 119 KIAS	-605.	12100.
53.	LAT. CONT. REVERSAL- 119 KIAS	605.	9075.
54.	DIR. CONT. REVERSAL - 119 KIAS	0.	9680.
55.	PULLUP, LEVEL FLIGHT - 70 KIAS	-1815.	19360.
56.	PULLUP, LEVEL FLIGHT - 85 KIAS	-908.	14218.
57.	PULLUP, LEVEL FLIGHT- 105 KIAS	1210.	11495.
58.	PULLUP, LEVEL FLIGHT- 119 KIAS	303.	11193.
59.	PULLUP, LEVEL FLIGHT- 127 KIAS	1210.	10890.
60.	PULLUP, DIVE - 136 KIAS	-1210.	9075.
61.	AUTOROTATION ENTRY - 70 KIAS	-1210.	9075.
62.	STAB. AUTO, 324 RPM - 70 KIAS	-1513.	13613.
63.	STAB. AUTO, 324 RPM - 85 KIAS	-1210.	12705.
64.	STAB. AUTO, 324 RPM - 105 KIAS	-605.	9075.
65.	STAB. AUTO, 294 RPM - 85 KIAS	-618.	11734.
66.	STAB. AUTO, 339 RPM - 85 KIAS	1544.	10190.
67.	AUTO TURN, RIGHT - 70 KIAS	-1210.	17545.
68.	AUTO TURN, LEFT - 70 KIAS	-1815.	16335.
69.	AUTO PWR. RECOVERY	-1210.	12705.
70.	APPROACH AND FLARE TO HOVER	-1210.	21780.
71.	LEFT SIDESLIP - 70 KIAS	-1210.	12705.
72.	LEFT SIDESLIP - 85 KIAS	0.	12100.
73.	LEFT SIDESLIP - 136 KIAS	-907.	10587.
74.	RIGHT SIDESLIP - 70 KIAS	-1210.	9680.
75.	RIGHT SIDESLIP - 85 KIAS	605.	6655.
76.	RIGHT SIDESLIP - 136 KIAS	-605.	7865.
77.	DIVE, STEADY - 119 KIAS	-302.	7562.
78.	DIVE, STEADY - 136 KIAS	-1210.	6050.
79.	DIVE, RIGHT TURN - 119 KIAS	-605.	6655.
80.	DIVE, LEFT TURN - 119 KIAS	-907.	9982.
81.	DIVE, RIGHT TURN - 136 KIAS	-907.	6352.
82.	DIVE, LEFT TURN - 136 KIAS	-1512.	10587.
83.	DIVE, RT. TURN PULLUP- 119 KIAS	605.	15125.
84.	DIVE, LT. TURN PULLUP- 119 KIAS	605.	19965.
85.	DIVE, RT. TURN PULLUP- 136 KIAS	605.	11495.
86.	DIVE, LT. TURN PULLUP- 136 KIAS	605.	15730.
87.	DIVE, PULLUP - 119 KIAS	-302.	11192.
88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	7260.
89.	CLIMB, MAX. RATE, PUSHOVER- 136	-605.	15730.
90.	CLIMB, MAX. RATE, PUSHOVER- 65	-605.	12705.
91.	QUICK STOP - 136 KIAS TO HOVER.	-907.	18452.

TABLE E-4 - Continued

PARAMETER M.R. MAST BENDING @ 90 DEG. UNITS IN-LB ENDURANCE LIMIT 22610. STATIC LIMITS
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR			51.	TURN REVERSAL, MOD. - 136 KIAS	-653.	11750.
2.	NORMAL SHUTDOWN 100-0%			52.	F/A CONT. REVERSAL - 119 KIAS	-2874.	12452.
3.	NORMAL TAKEOFF			53.	LAT. CONT. REVERSAL- 119 KIAS	-319.	7344.
4.	JUMP TAKEOFF	1632.	19256.	54.	DIR. CONT. REVERSAL - 119 KIAS	958.	4789.
5.	HOVER IGE 324 RPM	-312.	10937.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	319.	13729.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	937.	12187.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	10856.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	312.	12812.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	319.	9259.
8.	HOVER, F/A REVERSAL	2235.	19476.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	958.	8621.
9.	HOVER, LAT. REVERSAL	639.	14687.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	1631.	8812.
10.	HOVER, DIR. REVERSAL	1277.	14049.	60.	PULLUP, DIVE - 136 KIAS	-326.	11423.
11.	SIDEWARD FLIGHT - RIGHT	0.	15964.	61.	AUTOROTATION ENTRY - 70 KIAS ..	639.	4470.
12.	SIDEWARD FLIGHT - LEFT	-319.	13729.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	958.	13091.
13.	REARWARD FLIGHT	319.	18838.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	12133.
14.	LEVEL FLIGHT - 70 KIAS	-958.	6705.	64.	STAB. AUTO, 324 RPM - 105 KIAS	-319.	11174.
15.	LEVEL FLIGHT - 85 KIAS	1277.	6386.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	319.	10536.
16.	LEVEL FLIGHT - 102 KIAS	958.	5428.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	1277.	10856.
17.	LEVEL FLIGHT - 119 KIAS	1596.	4151.	67.	AUTO TURN, RIGHT - 70 KIAS	958.	16922.
18.	LEVEL FLIGHT - 127 KIAS	-319.	4789.	68.	AUTO TURN, LEFT - 70 KIAS	639.	14687.
19.	LEVEL FLIGHT - 136 KIAS	-639.	5109.	69.	AUTO PWR. RECOVERY	319.	11175.
20.	CLIMB, 500 FPM - 70 KIAS	639.	5109.	70.	APPROACH AND FLARE TO HOVER ...	958.	15006.
21.	CLIMB, 1000 FPM - 70 KIAS	319.	4151.	71.	LEFT SIDESLIP - 70 KIAS	1277.	7663.
22.	CLIMB, 1500 FPM - 70 KIAS	319.	4151.	72.	LEFT SIDESLIP - 85 KIAS	2187.	7187.
23.	CLIMB, 500 FPM - 85 KIAS	958.	5428.	73.	LEFT SIDESLIP - 136 KIAS	0.	6528.
24.	CLIMB, 1000 FPM - 85 KIAS	319.	5428.	74.	RIGHT SIDESLIP - 70 KIAS	1596.	6705.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	4375.	75.	RIGHT SIDESLIP - 85 KIAS	2500.	6250.
26.	CLIMB, 500 FPM - 105 KIAS	958.	4151.	76.	RIGHT SIDESLIP - 136 KIAS	1306.	5222.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	3750.	77.	DIVE, STEADY - 119 KIAS	979.	5548.
28.	CLIMB, 500 FPM - 119 KIAS	0.	4375.	78.	DIVE, STEADY - 136 KIAS	326.	6854.
29.	CLIMB, MAX.RATE - 70 KIAS	652.	4569.	79.	DIVE, RIGHT TURN - 119 KIAS ...	326.	8812.
30.	CLIMB, MAX.RATE - 105 KIAS	-319.	5428.	80.	DIVE, LEFT TURN - 119 KIAS	0.	7833.
31	CLIMB, MAX.RATE - 119 KIAS	319.	4787.	81.	DIVE, RIGHT TURN - 136 KIAS ...	979.	8812.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	8301.	82.	DIVE, LEFT TURN - 136 KIAS ...	326.	12729.
33.	LEFT TURN, 70 KIAS	958.	24585.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	-1915.	13409.
34.	LEFT TURN, 85 KIAS	319.	18838.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	-957.	16921.
35.	LEFT TURN, 105 KIAS	-958.	15645.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	-957.	13729.
36.	LEFT TURN, 119 KIAS	979.	15993.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	-957.	15006.
37.	LEFT TURN, 127 KIAS	319.	9259.	87.	DIVE, PULLUP - 119 KIAS	0.	11494.
38.	LEFT TURN, 136 KIAS	979.	12075.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	652.	4569.
39.	RIGHT TURN, 70 KIAS	958.	18199.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	3831.	20434.
40.	RIGHT TURN, 85 KIAS	0.	17241.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	979.	8812.
41.	RIGHT TURN, 105 KIAS	-319.	13090.	91.	QUICK STOP - 136 KIAS TO HOVER.	979.	13382.
42.	RIGHT TURN, 119 KIAS	-639.	12771.				
43.	RIGHT TURN, 127 KIAS	319.	9898.				
44.	RIGHT TURN, 136 KIAS	0.	9375.				
45.	TURN REVERSAL, MILD - 70 KIAS .	1277.	10856.				
46.	TURN REVERSAL, MILD - 85 KIAS .	319.	10536.				
47.	TURN REVERSAL, MILD - 105 KIAS	319.	11175.				
48.	TURN REVERSAL, MILD - 119 KIAS	979.	10117.				
49.	TURN REVERSAL, MILD - 136 KIAS	319.	10536.				
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	9791.				

TABLE E-4 - Continued

PARAMETER THRUST LINK LOAD UNITS LB ENDURANCE LIMIT 5054. STATIC LIMITS
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR		
2.	NORMAL SHUTDOWN 100-0%		
3.	NORMAL TAKEOFF		
4.	JUMP TAKEOFF	10398.	928.
5.	HOVER IGE 324 RPM	8095.	720.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	8224.	914.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	7950.	640.
8.	HOVER, F/A REVERSAL	9470.	1114.
9.	HOVER, LAT. REVERSAL	7985.	1300.
10.	HOVER, DIR. REVERSAL	8542.	743.
11.	SIDEWARD FLIGHT - RIGHT	10142.	1371.
12.	SIDEWARD FLIGHT - LEFT	8275.	1259.
13.	REARWARD FLIGHT	8635.	1259.
14.	LEVEL FLIGHT - 70 KIAS	8224.	1097.
15.	LEVEL FLIGHT - 85 KIAS	8132.	1188.
16.	LEVEL FLIGHT - 102 KIAS	8498.	1736.
17.	LEVEL FLIGHT - 119 KIAS	8772.	2010.
18.	LEVEL FLIGHT - 127 KIAS	8589.	2376.
19.	LEVEL FLIGHT - 136 KIAS	8589.	2589.
20.	CLIMB, 500 FPM - 70 KIAS	8820.	1207.
21.	CLIMB, 1000 FPM - 70 KIAS	7950.	640.
22.	CLIMB, 1500 FPM - 70 KIAS	8170.	743.
23.	CLIMB, 500 FPM - 85 KIAS	8542.	1300.
24.	CLIMB, 1000 FPM - 85 KIAS	8315.	1005.
25.	CLIMB, 1500 FPM - 85 KIAS	8315.	822.
26.	CLIMB, 500 FPM - 105 KIAS	8224.	1462.
27.	CLIMB, 1000 FPM - 105 KIAS	8589.	1462.
28.	CLIMB, 500 FPM - 119 KIAS	8498.	1736.
29.	CLIMB, MAX.RATE - 70 KIAS	8263.	649.
30.	CLIMB, MAX.RATE - 105 KIAS	8224.	1097.
31.	CLIMB, MAX.RATE - 119 KIAS	8681.	1736.
32.	CLIMB, MAX.RATE - 136 KIAS	9686.	2376.
33.	LEFT TURN, 70 KIAS	12441.	2228.
34.	LEFT TURN, 85 KIAS	12626.	1857.
35.	LEFT TURN, 105 KIAS	11049.	2507.
36.	LEFT TURN, 119 KIAS	12905.	2321.
37.	LEFT TURN, 127 KIAS	10417.	2376.
38.	LEFT TURN, 136 KIAS	12626.	2785.
39.	RIGHT TURN, 70 KIAS	12427.	2010.
40.	RIGHT TURN, 85 KIAS	11977.	2692.
41.	RIGHT TURN, 105 KIAS	11327.	2228.
42.	RIGHT TURN, 119 KIAS	12627.	2228.
43.	RIGHT TURN, 127 KIAS	11696.	2559.
44.	RIGHT TURN, 136 KIAS	10691.	2650.
45.	TURN REVERSAL, MILD - 70 KIAS .	10213.	1300.
46.	TURN REVERSAL, MILD - 85 KIAS .	10677.	2321.
47.	TURN REVERSAL, MILD - 105 KIAS	10691.	2650.
48.	TURN REVERSAL, MILD - 119 KIAS	10305.	2506.
49.	TURN REVERSAL, MILD - 136 KIAS	10027.	2785.
50.	TURN REVERSAL, MOD. - 105 KIAS	10882.	2692.
51.	TURN REVERSAL, MOD. - 136 KIAS	9284.	3342.
52.	F/A CONT. REVERSAL - 119 KIAS	3107.	8041.
53.	LAT. CONT. REVERSAL - 119 KIAS	8681.	2284.
54.	DIR. CONT. REVERSAL - 119 KIAS	8498.	2102.
55.	PULLUP, LEVEL FLIGHT - 70 KIAS	10143.	1919.
56.	PULLUP, LEVEL FLIGHT - 85 KIAS	11141.	1671.
57.	PULLUP, LEVEL FLIGHT- 105 KIAS	10600.	2010.
58.	PULLUP, LEVEL FLIGHT- 119 KIAS	10965.	2193.
59.	PULLUP, LEVEL FLIGHT- 127 KIAS	10955.	2228.
60.	PULLUP, DIVE - 136 KIAS	10212.	2042.
61.	AUTOROTATION ENTRY - 70 KIAS ..	7056.	1114.
62.	STAB. AUTO, 324 RPM - 70 KIAS .	8315.	822.
63.	STAB. AUTO, 324 RPM - 85 KIAS .	8498.	1371.
64.	STAB. AUTO, 324 RPM - 105 KIAS	8820.	1950.
65.	STAB. AUTO, 294 RPM - 85 KIAS .	8263.	1207.
66.	STAB. AUTO, 339 RPM - 85 KIAS .	8820.	1578.
67.	AUTO TURN, RIGHT - 70 KIAS	10508.	1188.
68.	AUTO TURN, LEFT - 70 KIAS	8681.	1005.
69.	AUTO PWR. RECOVERY	7676.	2559.
70.	APPROACH AND FLARE TO HOVER ...	8772.	1097.
71.	LEFT SIDESLIP - 70 KIAS	8132.	1188.
72.	LEFT SIDESLIP - 85 KIAS	8224.	1097.
73.	LEFT SIDESLIP - 136 KIAS	8772.	2376.
74.	RIGHT SIDESLIP - 70 KIAS	8681.	1005.
75.	RIGHT SIDESLIP - 85 KIAS	9046.	1371.
76.	RIGHT SIDESLIP - 136 KIAS	8820.	2692.
77.	DIVE, STEADY - 119 KIAS	8077.	2135.
78.	DIVE, STEADY - 136 KIAS	8449.	2321.
79.	DIVE, RIGHT TURN - 119 KIAS ...	10305.	2135.
80.	DIVE, LEFT TURN - 119 KIAS	9470.	2228.
81.	DIVE, RIGHT TURN - 136 KIAS ...	10120.	2506.
82.	DIVE, LEFT TURN - 136 KIAS ...	10955.	2228.
83.	DIVE, RT. TURN PULLUP- 119 KIAS	11878.	1644.
84.	DIVE, LT. TURN PULLUP- 119 KIAS	11969.	1736.
85.	DIVE, RT. TURN PULLUP- 136 KIAS	12334.	1918.
86.	DIVE, LT. TURN PULLUP- 136 KIAS	12152.	1736.
87.	DIVE, PULLUP - 119 KIAS	2042.	11141.
88.	CLIMB, MAX. RATE, PUSHOVER- 70	5756.	557.
89.	CLIMB, MAX. RATE, PUSHOVER- 136	3342.	2043.
90.	CLIMB, MAX. RATE, PUSHOVER- 65	6313.	557.
91.	QUICK STOP - 136 KIAS TO HOVER.	9563.	835.

TABLE E-4 - Continued

PARAMETER LATERAL ACTUATOR LOAD UNITS LB ENDURANCE LIMIT 1290. STATIC LIMITS

TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR		
2.	NORMAL SHUTDOWN 100-0%		
3.	NORMAL TAKEOFF		
4.	JUMP TAKEOFF	372.	466.
5.	HOVER IGE 324 RPM	383.	352.
6.	HOVER TURN, RIGHT 30 DEG/SEC	231.	293.
7.	HOVER TURN, LEFT 30 DEG/SEC	401.	370.
8.	HOVER, F/A REVERSAL	517.	548.
9.	HOVER, LAT. REVERSAL	376.	595.
10.	HOVER, DIR. REVERSAL	250.	313.
11.	SIDEWARD FLIGHT - RIGHT	46.	295.
12.	SIDEWARD FLIGHT - LEFT	521.	521.
13.	REARWARD FLIGHT	419.	481.
14.	LEVEL FLIGHT - 70 KIAS	-280.	559.
15.	LEVEL FLIGHT - 85 KIAS	-715.	684.
16.	LEVEL FLIGHT - 102 KIAS	-575.	575.
17.	LEVEL FLIGHT - 119 KIAS	-704.	673.
18.	LEVEL FLIGHT - 127 KIAS	-720.	751.
19.	LEVEL FLIGHT - 136 KIAS	-571.	787.
20.	CLIMB, 500 FPM - 70 KIAS	-423.	548.
21.	CLIMB, 1000 FPM - 70 KIAS	-262.	509.
22.	CLIMB, 1500 FPM - 70 KIAS	-329.	548.
23.	CLIMB, 500 FPM - 85 KIAS	-548.	611.
24.	CLIMB, 1000 FPM - 85 KIAS	-482.	606.
25.	CLIMB, 1500 FPM - 85 KIAS	-432.	617.
26.	CLIMB, 500 FPM - 105 KIAS	-497.	559.
27.	CLIMB, 1000 FPM - 105 KIAS	-432.	617.
28.	CLIMB, 500 FPM - 119 KIAS	-432.	648.
29.	CLIMB, MAX.RATE - 70 KIAS	-482.	575.
30.	CLIMB, MAX.RATE - 105 KIAS	-524.	586.
31.	CLIMB, MAX.RATE - 119 KIAS	-632.	694.
32.	CLIMB, MAX.RATE - 136 KIAS	-710.	802.
33.	LEFT TURN, 70 KIAS	626.	658.
34.	LEFT TURN, 85 KIAS	-46.	972.
35.	LEFT TURN, 105 KIAS	-1095.	1404.
36.	LEFT TURN, 119 KIAS	-854.	1383.
37.	LEFT TURN, 127 KIAS	-648.	1013.
38.	LEFT TURN, 136 KIAS	-1150.	1181.
39.	RIGHT TURN, 70 KIAS	-344.	1001.
40.	RIGHT TURN, 85 KIAS	-482.	1290.
41.	RIGHT TURN, 105 KIAS	-632.	1527.
42.	RIGHT TURN, 119 KIAS	-663.	1311.
43.	RIGHT TURN, 127 KIAS	-756.	972.
44.	RIGHT TURN, 136 KIAS	-571.	941.
45.	TURN REVERSAL, MILD - 70 KIAS	-517.	704.
46.	TURN REVERSAL, MILD - 85 KIAS	-798.	1080.
47.	TURN REVERSAL, MILD - 105 KIAS	-895.	12[illegible]4.
48.	TURN REVERSAL, MILD - 119 KIAS	-777.	1119.
49.	TURN REVERSAL, MILD - 136 KIAS	-725.	848.
50.	TURN REVERSAL, MOD. - 105 KIAS	-899.	1299.
51.	TURN REVERSAL, MOD. - 136 KIAS	-901.	1118.
52.	F/A CONT. REVERSAL - 119 KIAS	-699.	855.
53.	LAT. CONT. REVERSAL- 119 KIAS	-606.	793.
54.	DIR. CONT. REVERSAL - 119 KIAS	-637.	668.
55.	PULLUP, LEVEL FLIGHT - 70 KIAS	-157.	783.
56.	PULLUP, LEVEL FLIGHT - 85 KIAS	-689.	1002.
57.	PULLUP, LEVEL FLIGHT- 105 KIAS	-559.	1181.
58.	PULLUP, LEVEL FLIGHT- 119 KIAS	-740.	1141.
59.	PULLUP, LEVEL FLIGHT- 127 KIAS	-699.	1103.
60.	PULLUP, DIVE - 136 KIAS	-839.	994.
61.	AUTOROTATION ENTRY - 70 KIAS	-156.	344.
62.	STAB. AUTO, 324 RPM - 70 KIAS	93.	370.
63.	STAB. AUTO, 324 RPM - 85 KIAS	-31.	309.
64.	STAB. AUTO, 324 RPM - 105 KIAS	-485.	485.
65.	STAB. AUTO, 294 RPM - 85 KIAS	-438.	564.
66.	STAB. AUTO, 339 RPM - 85 KIAS	-204.	329.
67.	AUTO TURN, RIGHT - 70 KIAS	108.	602.
68.	AUTO TURN, LEFT - 70 KIAS	231.	447.
69.	AUTO PWR. RECOVERY	-648.	1080.
70.	APPROACH AND FLARE TO HOVER	324.	756.
71.	LEFT SIDESLIP - 70 KIAS	-93.	401.
72.	LEFT SIDESLIP - 85 KIAS	-386.	540.
73.	LEFT SIDESLIP - 136 KIAS	-621.	777.
74.	RIGHT SIDESLIP - 70 KIAS	432.	524.
75.	RIGHT SIDESLIP - 85 KIAS	-679.	617.
76.	RIGHT SIDESLIP - 136 KIAS	-699.	792.
77.	DIVE, STEADY - 119 KIAS	-574.	574.
78.	DIVE, STEADY - 136 KIAS	-652.	652.
79.	DIVE, RIGHT TURN - 119 KIAS	-808.	932.
80.	DIVE, LEFT TURN - 119 KIAS	-637.	730.
81.	DIVE, RIGHT TURN - 136 KIAS	-870.	870.
82.	DIVE, LEFT TURN - 136 KIAS	-901.	963.
83.	DIVE, RT. TURN PULLUP- 119 KIAS	-528.	1212.
84.	DIVE, LT. TURN PULLUP- 119 KIAS	-714.	1181.
85.	DIVE, RT. TURN PULLUP- 136 KIAS	-1025.	1305.
86.	DIVE, LT. TURN PULLUP- 136 KIAS	-777.	1243.
87.	DIVE, PULLUP - 119 KIAS	-864.	1141.
88.	CLIMB, MAX. RATE, PUSHOVER- 70	-482.	637.
89.	CLIMB, MAX. RATE, PUSHOVER- 136	-648.	833.
90.	CLIMB, MAX. RATE, PUSHOVER- 65	-108.	326.
91.	QUICK STOP - 136 KIAS TO HOVER.	-559.	683.

TABLE E-4 - Continued

PARAMETER M.R. DRIVESHAFT TORSION   UNITS IN-LB   ENDURANCE LIMIT 38980.   STATIC LIMITS
TOGW= 8476 LB   TOCG= 192.4 IN   HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR		
2.	NORMAL SHUTDOWN 100-0%		
3.	NORMAL TAKEOFF		
4.	JUMP TAKEOFF	229574.	2962.
5.	HOVER IGE 324 RPM	146126.	3280.
6.	HOVER TURN, RIGHT 30 DEG/SEC	158110.	3333.
7.	HOVER TURN, LEFT 30 DEG/SEC	146631.	3703.
8.	HOVER, F/A REVERSAL	156562.	7527.
9.	HOVER, LAT. REVERSAL	165594.	4516.
10.	HOVER, DIR. REVERSAL	164841.	23334.
11.	SIDEWARD FLIGHT - RIGHT	118065.	10203.
12.	SIDEWARD FLIGHT - LEFT	160336.	4372.
13.	REARWARD FLIGHT	142844.	6560.
14.	LEVEL FLIGHT - 70 KIAS	90737.	2551.
15.	LEVEL FLIGHT - 85 KIAS	106883.	2258.
16.	LEVEL FLIGHT - 102 KIAS	113694.	2915.
17.	LEVEL FLIGHT - 119 KIAS	142482.	2551.
18.	LEVEL FLIGHT - 127 KIAS	161067.	2915.
19.	LEVEL FLIGHT - 136 KIAS	188762.	2186.
20.	CLIMB, 500 FPM - 70 KIAS	131723.	2258.
21.	CLIMB, 1000 FPM - 70 KIAS	154304.	753.
22.	CLIMB, 1500 FPM - 70 KIAS	169358.	1505.
23.	CLIMB, 500 FPM - 85 KIAS		
24.	CLIMB, 1000 FPM - 85 KIAS	139203.	1458.
25.	CLIMB, 1500 FPM - 85 KIAS	177465.	2551.
26.	CLIMB, 500 FPM - 105 KIAS	149770.	2551.
27.	CLIMB, 1000 FPM - 105 KIAS	173457.	3644.
28.	CLIMB, 500 FPM - 119 KIAS	169448.	1822.
29.	CLIMB, MAX.RATE - 70 KIAS	207357.	12590.
30.	CLIMB, MAX.RATE - 105 KIAS	203337.	2186.
31.	CLIMB, MAX.RATE - 119 KIAS	204795.	2186.
32.	CLIMB, MAX.RATE - 136 KIAS	207356.	4443.
33.	LEFT TURN, 70 KIAS	43280.	3387.
34.	LEFT TURN, 85 KIAS	48136.	6665.
35.	LEFT TURN, 105 KIAS	81091.	5554.
36.	LEFT TURN, 119 KIAS	113676.	3333.
37.	LEFT TURN, 127 KIAS	159609.	2915.
38.	LEFT TURN, 136 KIAS	158480.	4443.
39	RIGHT TURN, 70 KIAS	60969.	3011.
40.	RIGHT TURN, 85 KIAS	60356.	3333.
41.	RIGHT TURN, 105 KIAS	113281.	4140.
42.	RIGHT TURN, 119 KIAS	114416.	3332.
43.	RIGHT TURN, 127 KIAS	147219.	5830.
44.	RIGHT TURN, 136 KIAS	186942.	2551.
45.	TURN REVERSAL, MILD - 70 KIAS	103120.	3764.
46.	TURN REVERSAL, MILD - 85 KIAS		
47.	TURN REVERSAL, MILD - 105 KIAS	124990.	3280.
48.	TURN REVERSAL, MILD - 119 KIAS	148853.	2962.
49.	TURN REVERSAL, MILD - 136 KIAS	165515.	4073.
50.	TURN REVERSAL, MOD. - 105 KIAS	138114.	2592.
51.	TURN REVERSAL, MOD. - 136 KIAS	184399.	4443.
52.	F/A CONT. REVERSAL - 119 KIAS	145398.	1822.
53.	LAT. CONT. REVERSAL- 119 KIAS	149770.	6924.
54.	DIR. CONT. REVERSAL - 119 KIAS	143576.	5102.
55.	PULLUP, LEVEL FLIGHT - 70 KIAS	71507.	3011.
56.	PULLUP, LEVEL FLIGHT - 85 KIAS		
57.	PULLUP, LEVEL FLIGHT- 105 KIAS	112237.	2186.
58.	PULLUP, LEVEL FLIGHT- 119 KIAS	142846.	3644.
59.	PULLUP, LEVEL FLIGHT- 127 KIAS	131079.	3703.
60.	PULLUP, DIVE - 136 KIAS	66280.	3333.
61.	AUTOROTATION ENTRY - 70 KIAS	89948.	2634.
62.	STAB. AUTO, 324 RPM - 70 KIAS	-5645.	1129.
63.	STAB. AUTO, 324 RPM - 85 KIAS	-5269.	1505.
64.	STAB. AUTO, 324 RPM - 105 KIAS		
65.	STAB. AUTO, 294 RPM - 85 KIAS	-5645.	1882.
66.	STAB. AUTO, 339 RPM - 85 KIAS	-9409.	2634.
67.	AUTO TURN, RIGHT - 70 KIAS	-6774.	1505.
68.	AUTO TURN, LEFT - 70 KIAS	-5645.	1129.
69.	AUTO PWR. RECOVERY	33119.	39140.
70.	APPROACH AND FLARE TO HOVER	100485.	4893.
71.	LEFT SIDESLIP - 70 KIAS	93711.	1129.
72.	LEFT SIDESLIP - 85 KIAS	100211.	1822.
73.	LEFT SIDESLIP - 136 KIAS	182548.	3333.
74.	RIGHT SIDESLIP - 70 KIAS	99356.	3011.
75.	RIGHT SIDESLIP - 85 KIAS	105677.	2915.
76.	RIGHT SIDESLIP - 136 KIAS	186621.	3703.
77.	DIVE, STEADY - 119 KIAS	91089.	2222.
78.	DIVE, STEADY - 136 KIAS	85535.	3333.
79.	DIVE, RIGHT TURN - 119 KIAS	63318.	3333.
80.	DIVE, LEFT TURN - 119 KIAS	83683.	2222.
81.	DIVE, RIGHT TURN - 136 KIAS	74797.	2962.
82.	DIVE, LEFT TURN - 136 KIAS	64429.	2222.
83.	DIVE, RT. TURN PULLUP- 119 KIAS	46643.	3644.
84.	DIVE, LT. TURN PULLUP- 119 KIAS	41906.	3279.
85.	DIVE, RT. TURN PULLUP- 136 KIAS	52838.	3279.
86.	DIVE, LT. TURN PULLUP- 136 KIAS	43363.	2550.
87.	DIVE, PULLUP - 119 KIAS	58874.	3332.
88.	CLIMB, MAX. RATE, PUSHOVER- 70	169218.	1111.
89.	CLIMB, MAX. RATE, PUSHOVER- 136	195507.	3702.
90.	CLIMB, MAX. RATE, PUSHOVER- 65	180697.	1481.
91.	QUICK STOP - 136 KIAS TO HOVER.	151815.	2222.

TABLE E-4 - Continued

PARAMETER TEETER ANGLE UNITS DEG. ENDURANCE LIMIT STATIC LIMITS
TOGW= 8476 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR		
2.	NORMAL SHUTDOWN 100-0%		
3.	NORMAL TAKEOFF		
4.	JUMP TAKEOFF	0.00	6.50
5.	HOVER IGE 324 RPM	0.00	4.42
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.00	4.70
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.00	4.98
8.	HOVER, F/A REVERSAL	0.00	6.43
9.	HOVER, LAT. REVERSAL	0.00	5.83
10.	HOVER, DIR. REVERSAL	0.00	5.15
11.	SIDEWARD FLIGHT - RIGHT	0.00	8.84
12.	SIDEWARD FLIGHT - LEFT	0.00	4.58
13.	REARWARD FLIGHT	0.00	6.71
14.	LEVEL FLIGHT - 70 KIAS	0.00	2.69
15.	LEVEL FLIGHT - 85 KIAS	0.00	2.05
16.	LEVEL FLIGHT - 102 KIAS	0.00	1.33
17.	LEVEL FLIGHT - 119 KIAS	0.00	1.00
18.	LEVEL FLIGHT - 127 KIAS	0.00	1.05
19.	LEVEL FLIGHT - 136 KIAS	0.00	1.21
20.	CLIMB, 500 FPM - 70 KIAS	0.00	2.20
21.	CLIMB, 1000 FPM - 70 KIAS	0.00	1.45
22.	CLIMB, 1500 FPM - 70 KIAS	0.00	1.50
23.	CLIMB, 500 FPM - 85 KIAS	0.00	1.61
24.	CLIMB, 1000 FPM - 85 KIAS	0.00	1.45
25.	CLIMB, 1500 FPM - 85 KIAS	0.00	1.29
26.	CLIMB, 500 FPM - 105 KIAS	0.00	1.09
27.	CLIMB, 1000 FPM - 105 KIAS	0.00	1.09
28.	CLIMB, 500 FPM - 119 KIAS	0.00	1.01
29.	CLIMB, MAX.RATE - 70 KIAS	0.00	1.44
30.	CLIMB, MAX.RATE - 105 KIAS	0.00	1.29
31.	CLIMB, MAX.RATE - 119 KIAS	0.00	1.25
32.	CLIMB, MAX.RATE - 136 KIAS	0.00	1.89
33.	LEFT TURN, 70 KIAS	0.00	5.03
34.	LEFT TURN, 85 KIAS	0.00	3.98
35.	LEFT TURN, 105 KIAS	0.00	3.98
36.	LEFT TURN, 119 KIAS	0.00	4.38
37.	LEFT TURN, 127 KIAS	0.00	2.33
38.	LEFT TURN, 136 KIAS	0.00	3.82
39.	RIGHT TURN, 70 KIAS	0.00	4.02
40.	RIGHT TURN, 85 KIAS	0.00	4.38
41.	RIGHT TURN, 105 KIAS	0.00	4.18
42.	RIGHT TURN, 119 KIAS	0.00	3.82
43.	RIGHT TURN, 127 KIAS	0.00	3.30
44.	RIGHT TURN, 136 KIAS	0.00	2.57
45.	TURN REVERSAL, MILD - 70 KIAS .	0.00	3.54
46.	TURN REVERSAL, MILD - 85 KIAS .	0.00	3.38
47.	TURN REVERSAL, MILD - 105 KIAS	0.00	3.54
48.	TURN REVERSAL, MILD - 119 KIAS	0.00	2.97
49.	TURN REVERSAL, MILD - 136 KIAS	0.00	2.53
50.	TURN REVERSAL, MOD. - 105 KIAS	0.00	2.89

NO.	TEST CONDITION	MEAN.	OSC.
51.	TURN REVERSAL, MOD. - 136 KIAS	0.00	4.26
52.	F/A CONT. REVERSAL - 119 KIAS	0.00	1.61
53.	LAT. CONT. REVERSAL- 119 KIAS	0.00	1.81
54.	DIR. CONT. REVERSAL - 119 KIAS	0.00	1.00
55.	PULLUP, LEVEL FLIGHT - 70 KIAS	0.00	3.66
56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.00	3.10
57.	PULLUP, LEVEL FLIGHT- 105 KIAS	0.00	2.89
58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.00	3.02
59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.00	2.85
60.	PULLUP, DIVE - 136 KIAS	0.00	2.21
61.	AUTOROTATION ENTRY - 70 KIAS ..	0.00	1.85
62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.00	3.58
63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.00	2.94
64.	STAB. AUTO, 324 RPM - 105 KIAS	0.00	2.33
65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.00	3.10
66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.00	2.53
67.	AUTO TURN, RIGHT - 70 KIAS	0.00	3.54
68.	AUTO TURN, LEFT - 70 KIAS	0.00	3.58
69.	AUTO PWR. RECOVERY	0.00	3.62
70.	APPROACH AND FLARE TO HOVER ...	0.00	5.60
71.	LEFT SIDESLIP - 70 KIAS	0.00	2.61
72.	LEFT SIDESLIP - 85 KIAS	0.00	2.29
73.	LEFT SIDESLIP - 136 KIAS	0.00	1.41
74.	RIGHT SIDESLIP - 70 KIAS	0.00	2.69
75.	RIGHT SIDESLIP - 85 KIAS	0.00	2.25
76.	RIGHT SIDESLIP - 136 KIAS	0.00	1.21
77.	DIVE, STEADY - 119 KIAS	0.00	0.72
78.	DIVE, STEADY - 136 KIAS	0.00	0.64
79.	DIVE, RIGHT TURN - 119 KIAS ...	0.00	1.45
80.	DIVE, LEFT TURN - 119 KIAS	0.00	1.21
81.	DIVE, RIGHT TURN - 136 KIAS ...	0.00	1.05
82.	DIVE, LEFT TURN - 136 KIAS ...	0.00	2.29
83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.00	3.37
84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.00	3.86
85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.00	2.97
86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.00	3.42
87.	DIVE, PULLUP - 119 KIAS	0.00	2.49
88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.00	3.21
89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.00	5.39
90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.00	4.26
91.	QUICK STOP - 136 KIAS TO HOVER.	0.00	5.47

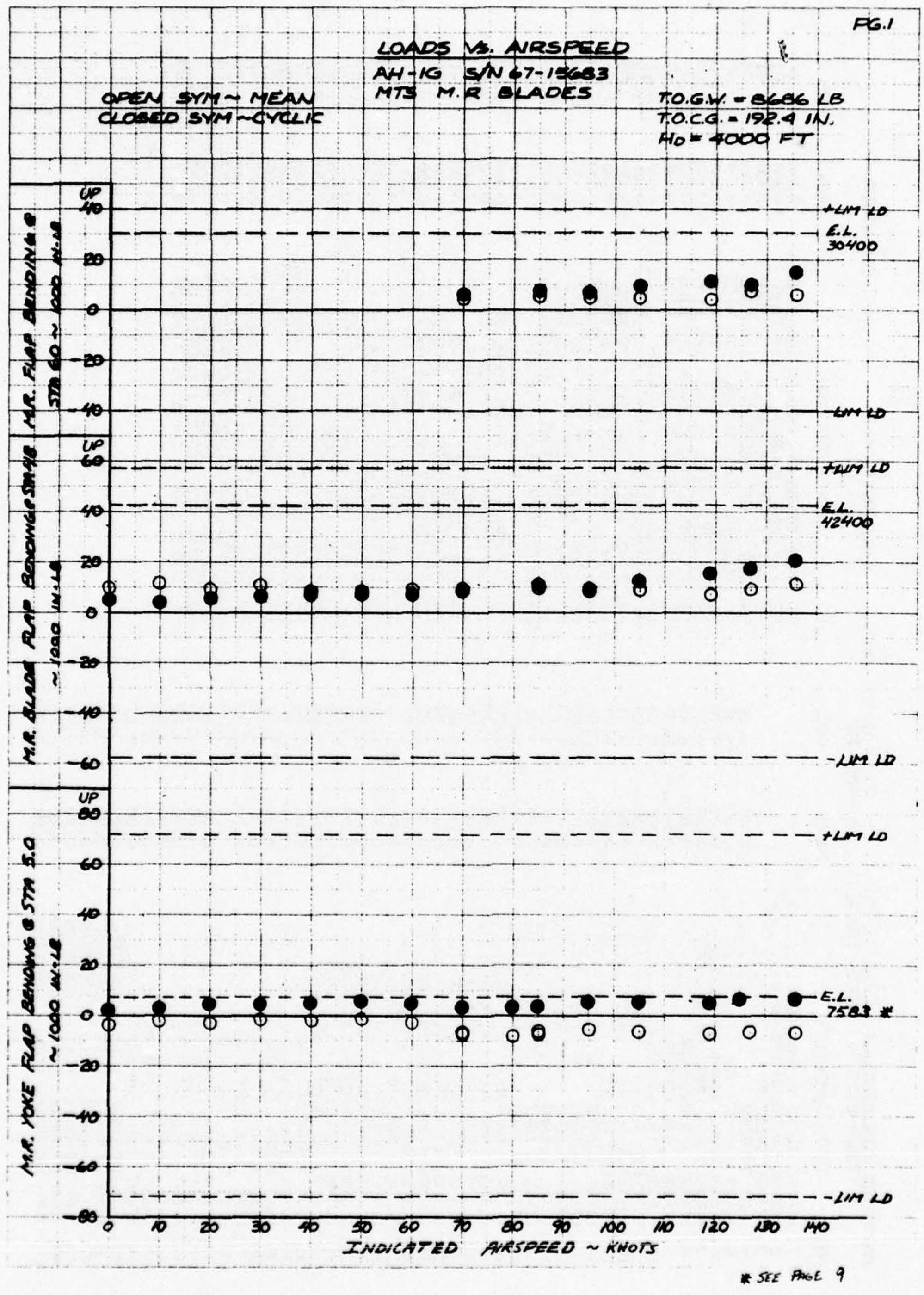


Figure. E-1. Loads versus airspeed (Sheet 1 of 9).

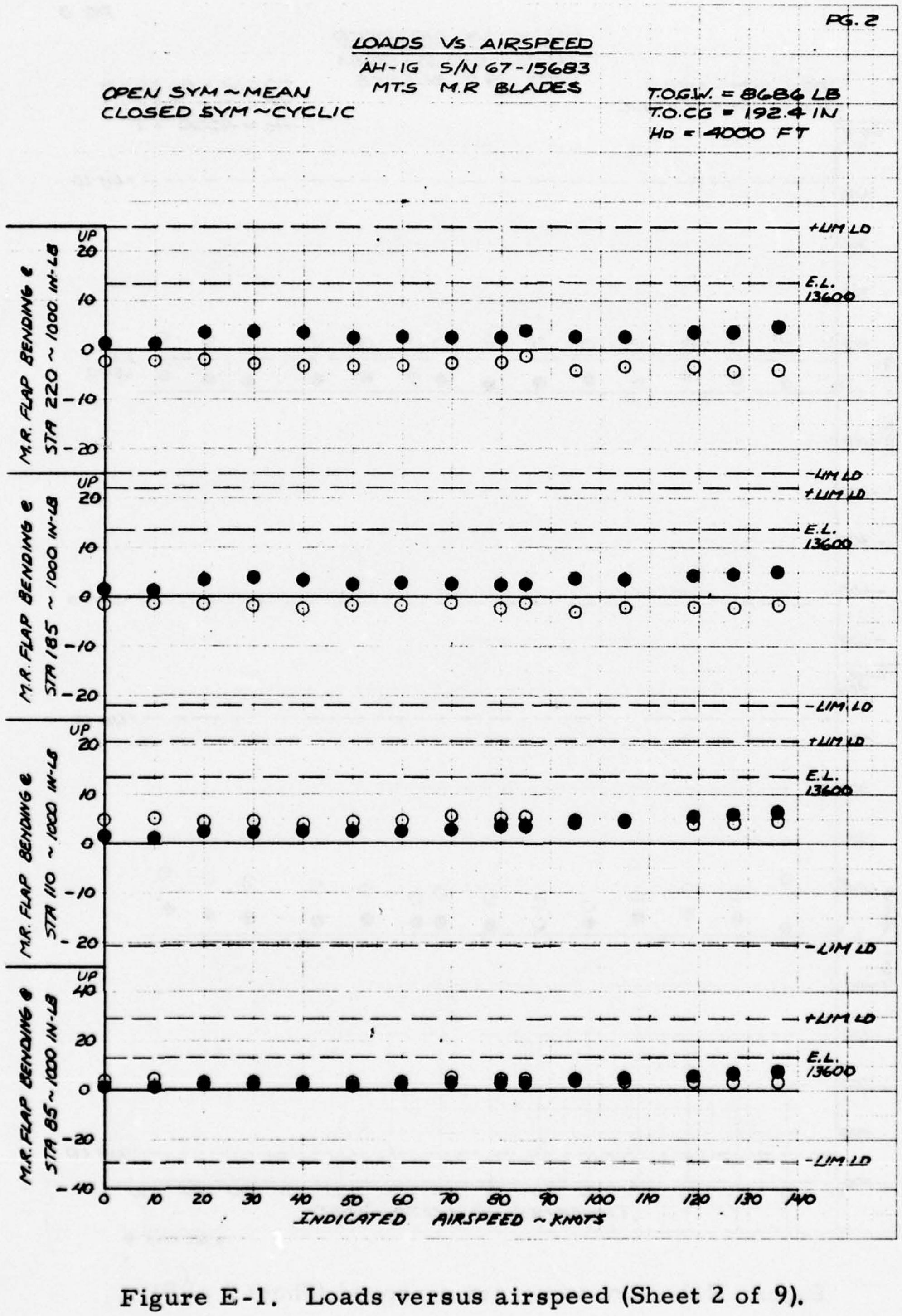


Figure E-1. Loads versus airspeed (Sheet 2 of 9).

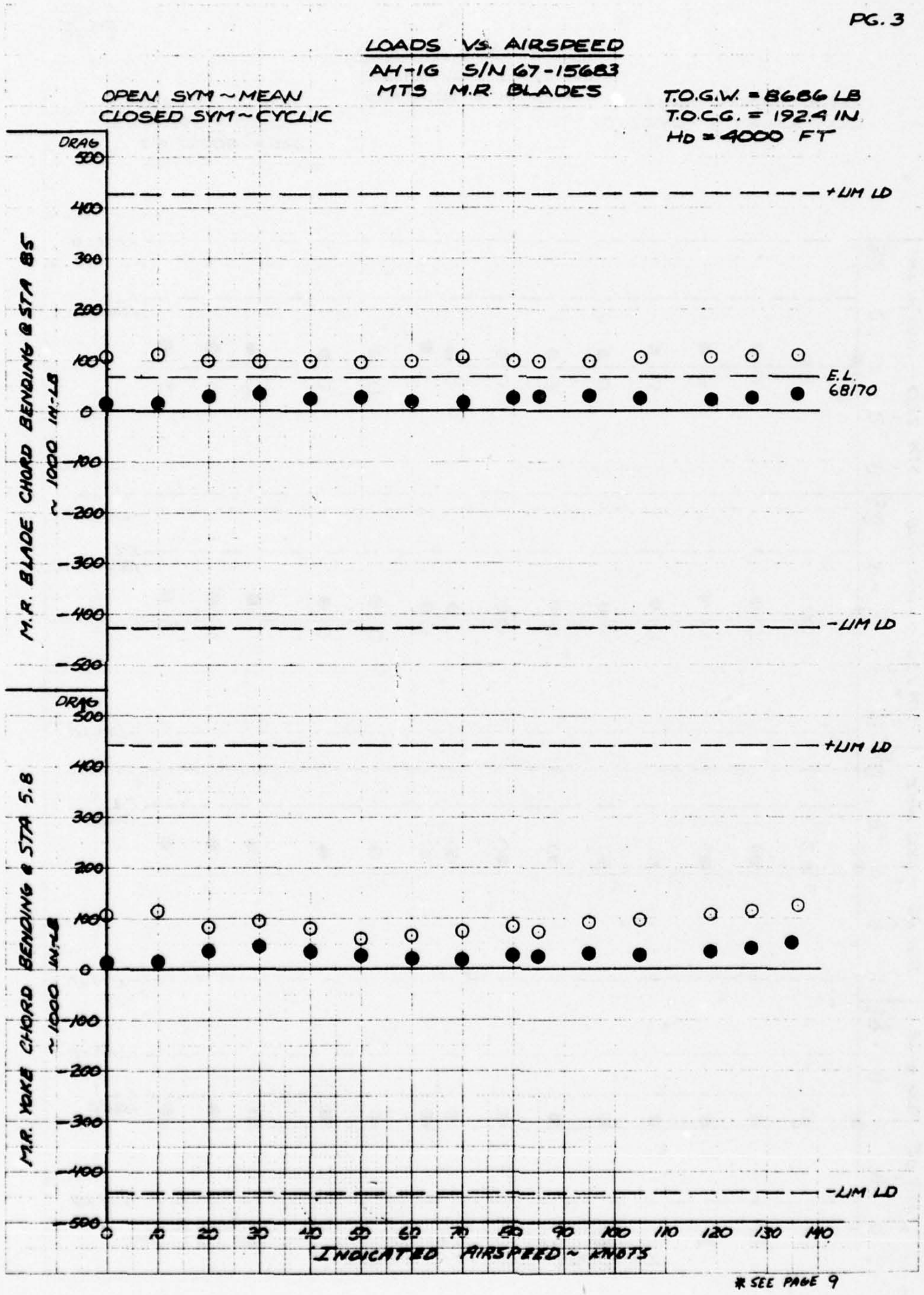


Figure E-1. Loads versus airspeed (Sheet 3 of 9).

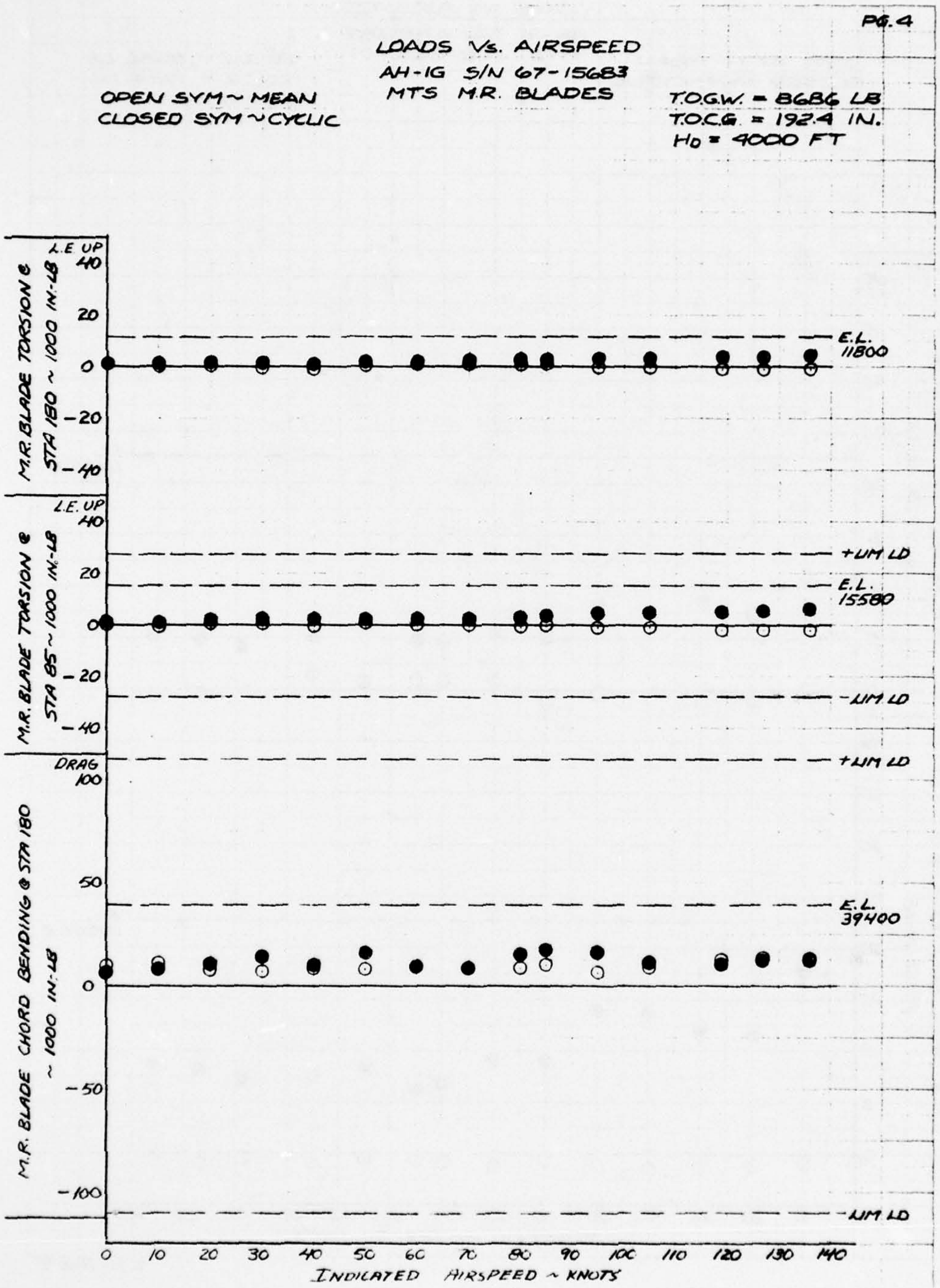


Figure E-1. Loads versus airspeed (Sheet 4 of 9).

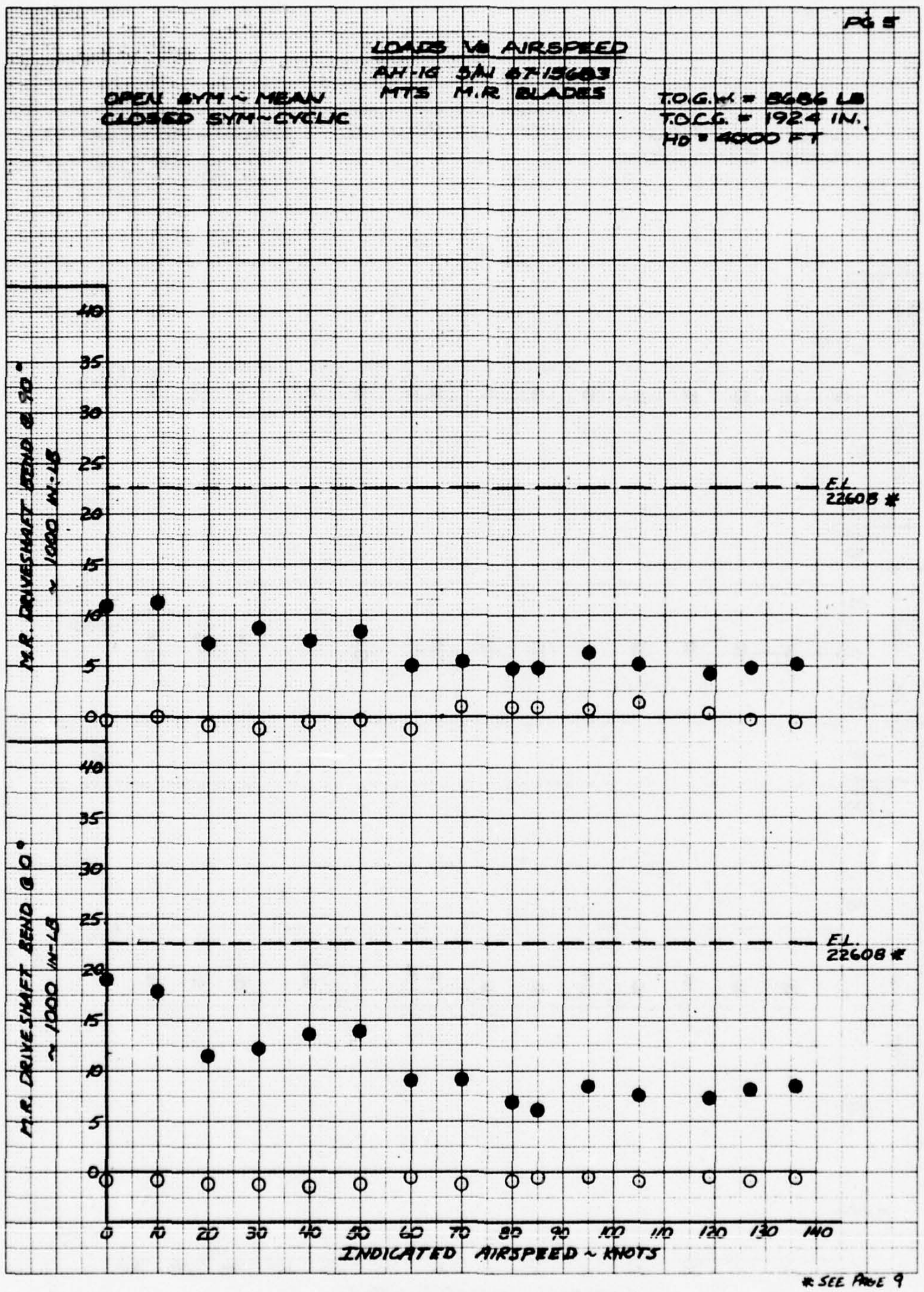


Figure E-1. Loads versus airspeed (Sheet 5 of 9).

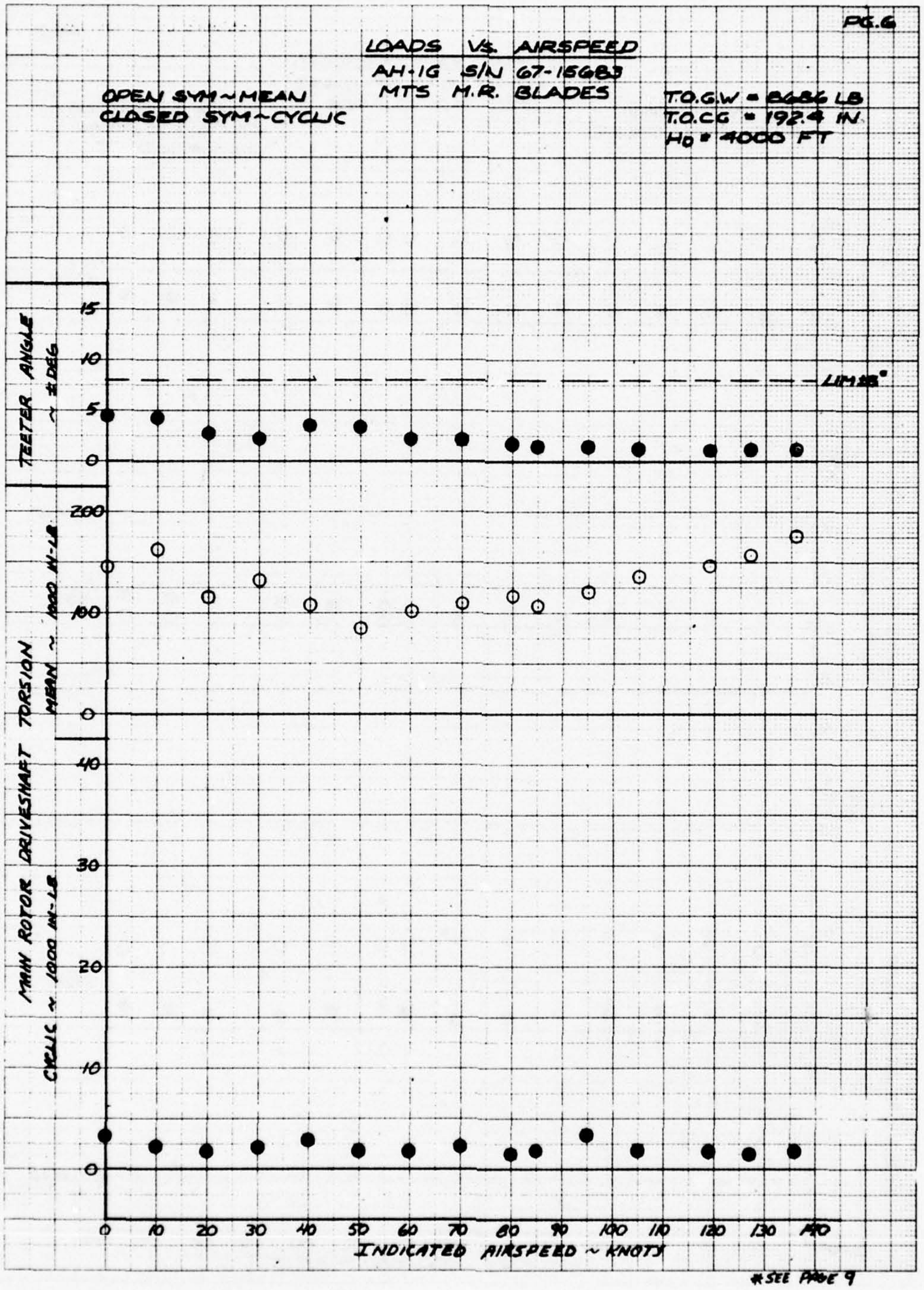


Figure E-1. Loads versus airspeed (Sheet 6 of 9).

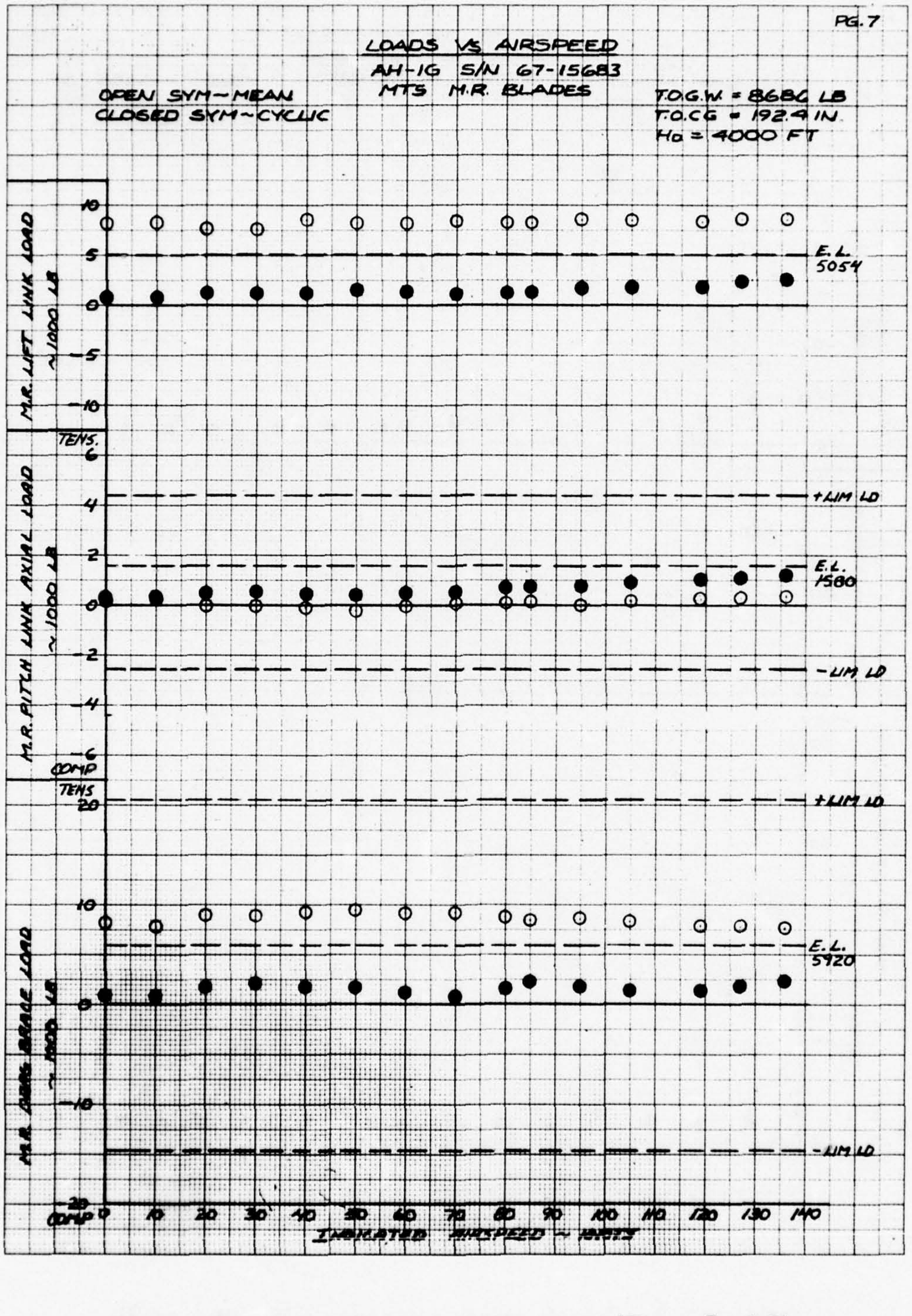


Figure E-1. Loads versus airspeed (Sheet 7 of 9).

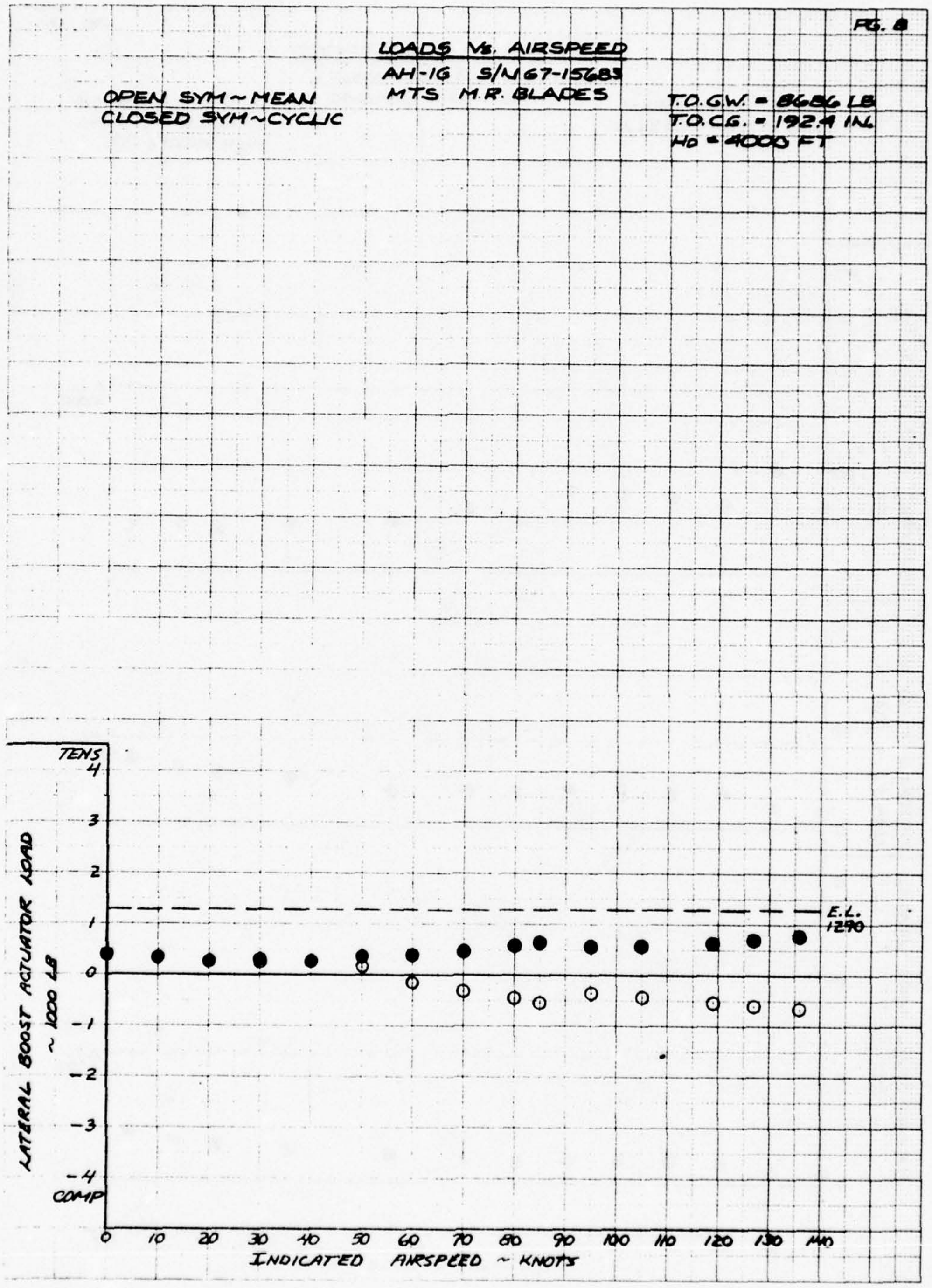


Figure E-1. Loads versus airspeed (Sheet 8 of 9).

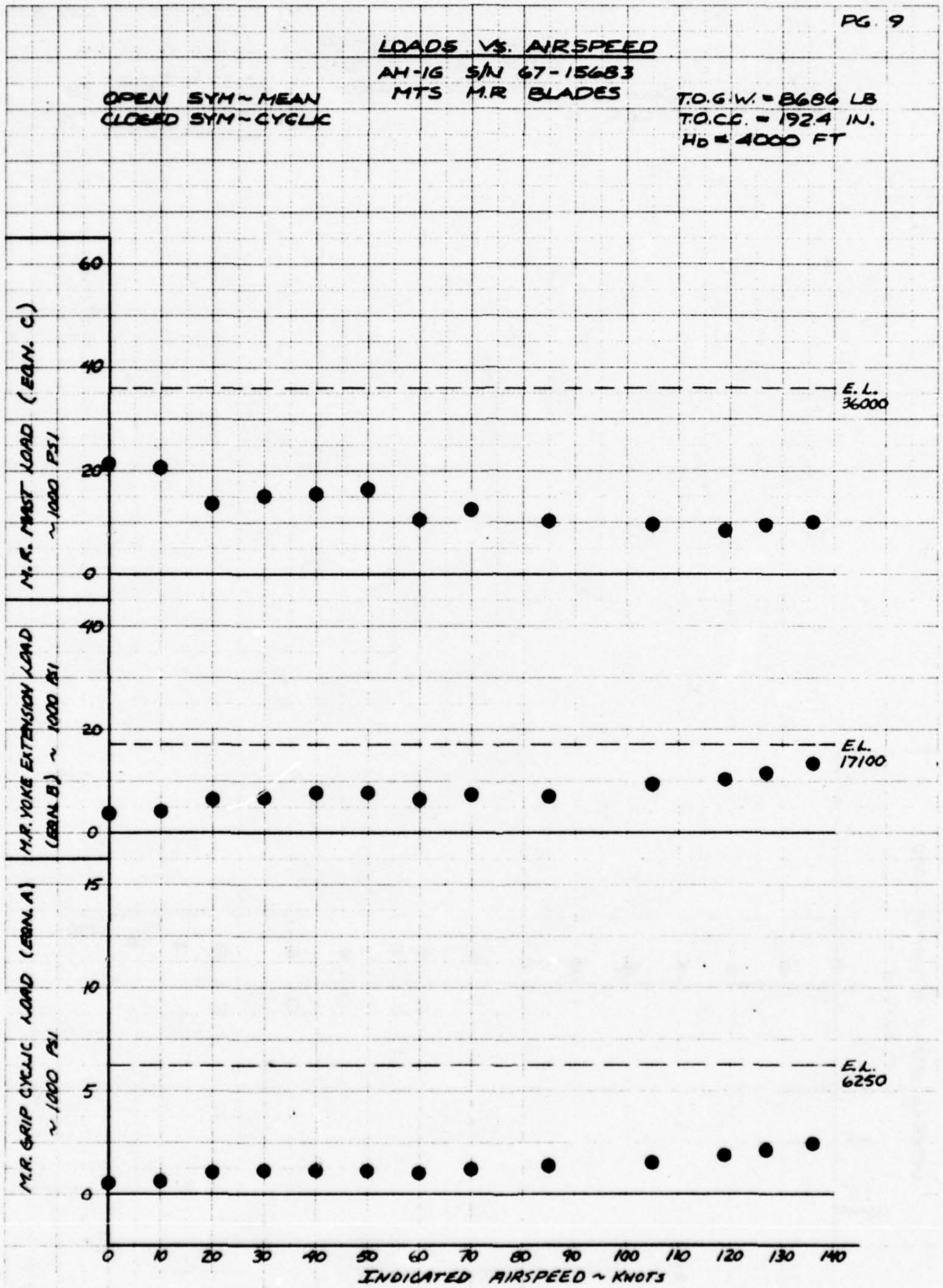


Figure E-1. Loads versus airspeed (Sheet 9 of 9).

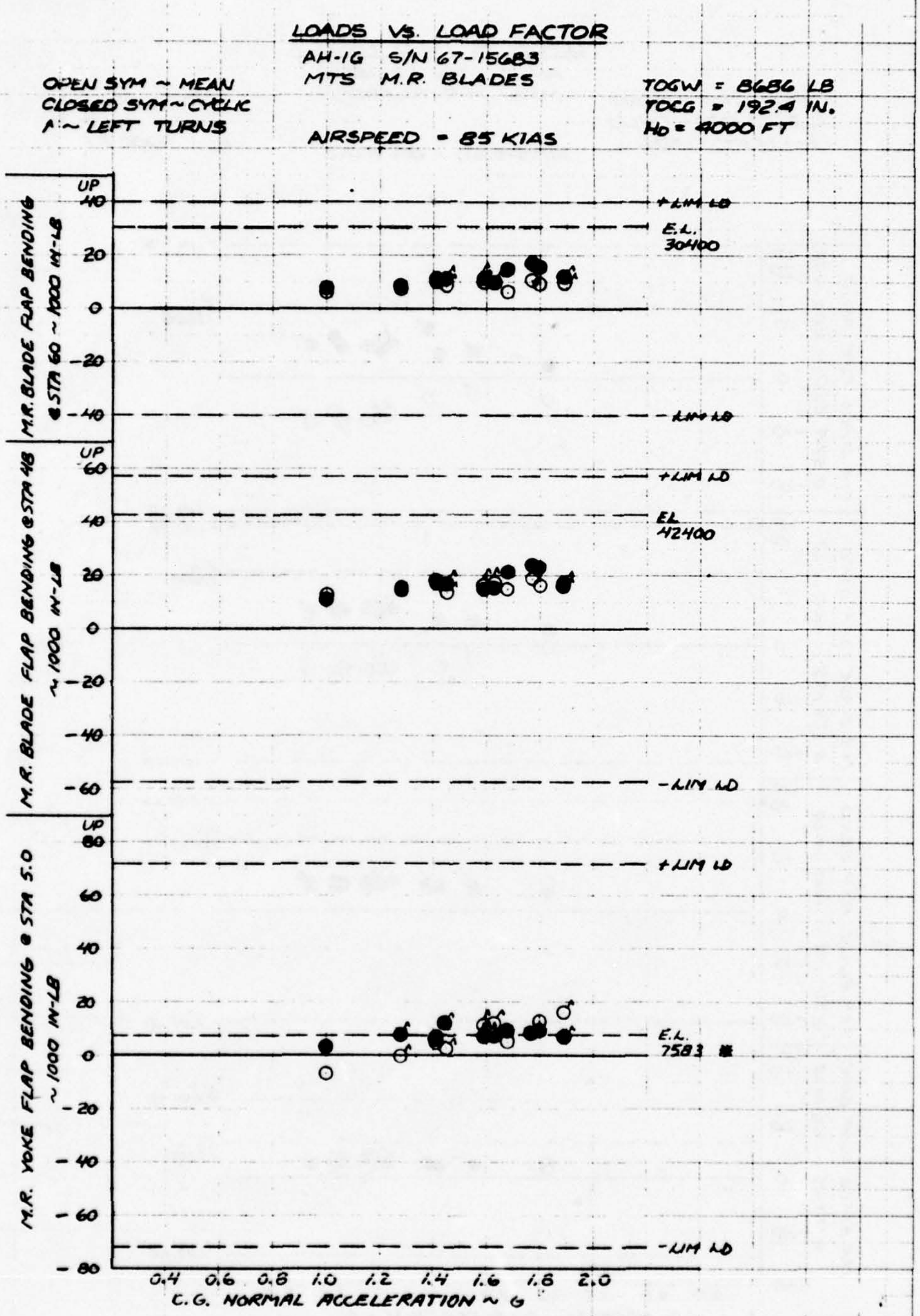


Figure E-2. Loads versus load factor – airspeed = 85 KIAS (Sheet 1 of 9).

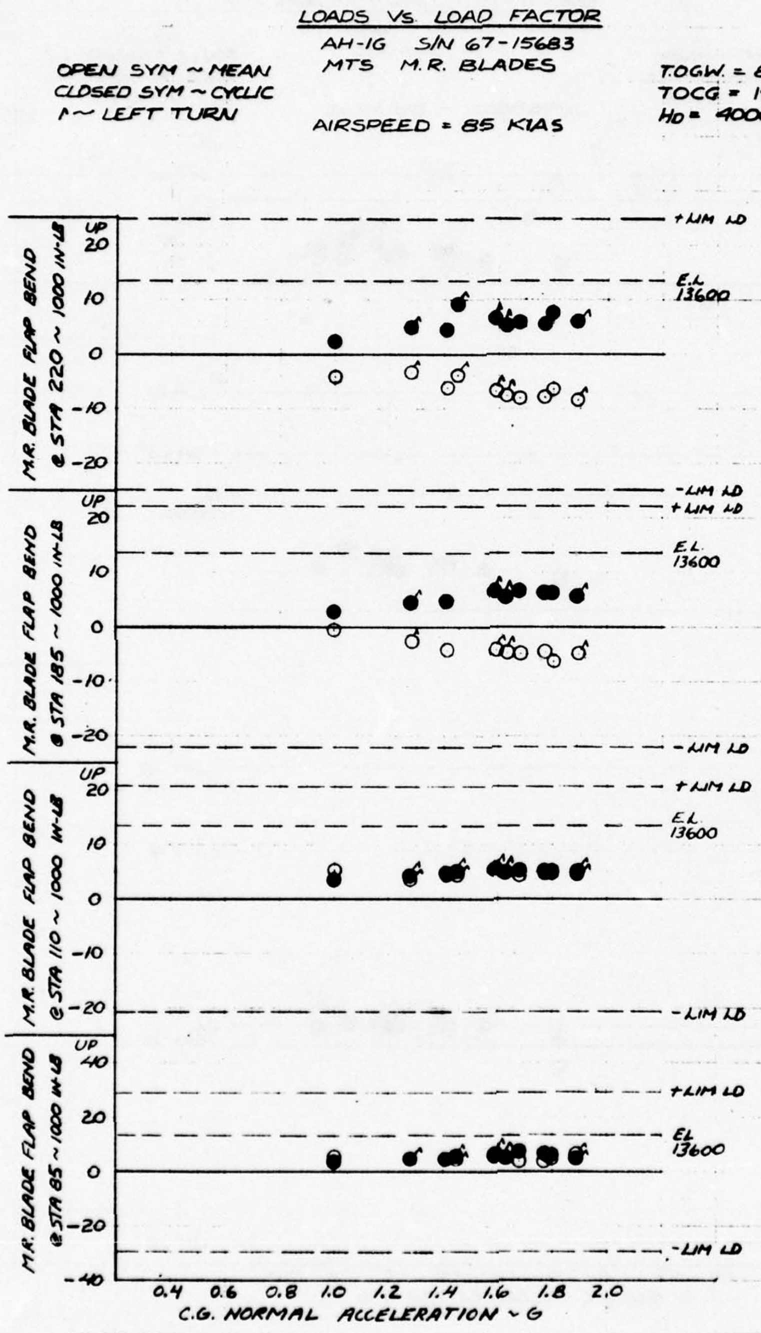


Figure E-2. Loads versus load factor - airspeed = 85 KIAS (Sheet 2 of 9).

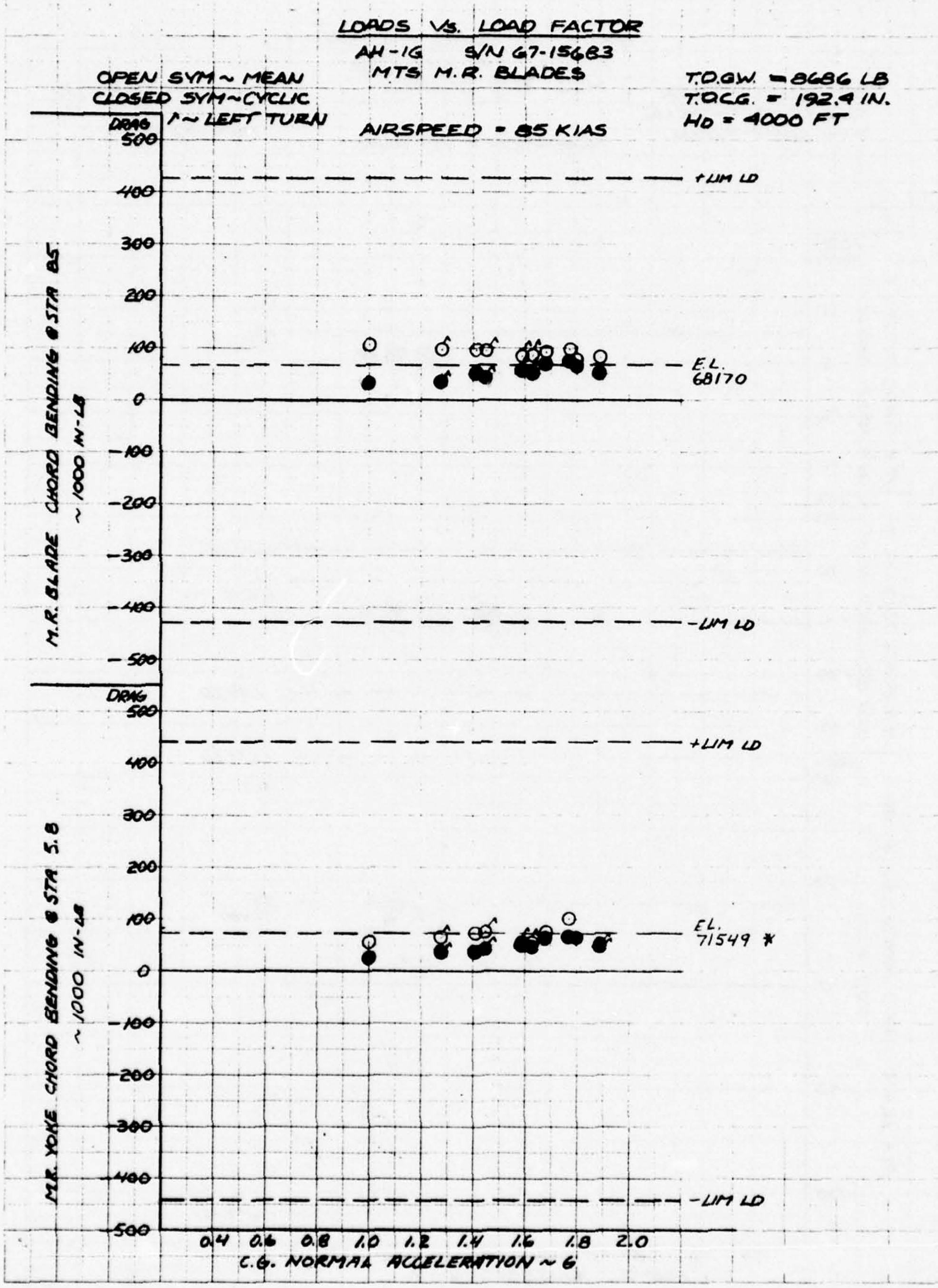


Figure E-2. Loads versus load factor – airspeed = 85 KIAS (Sheet 3 of 9).

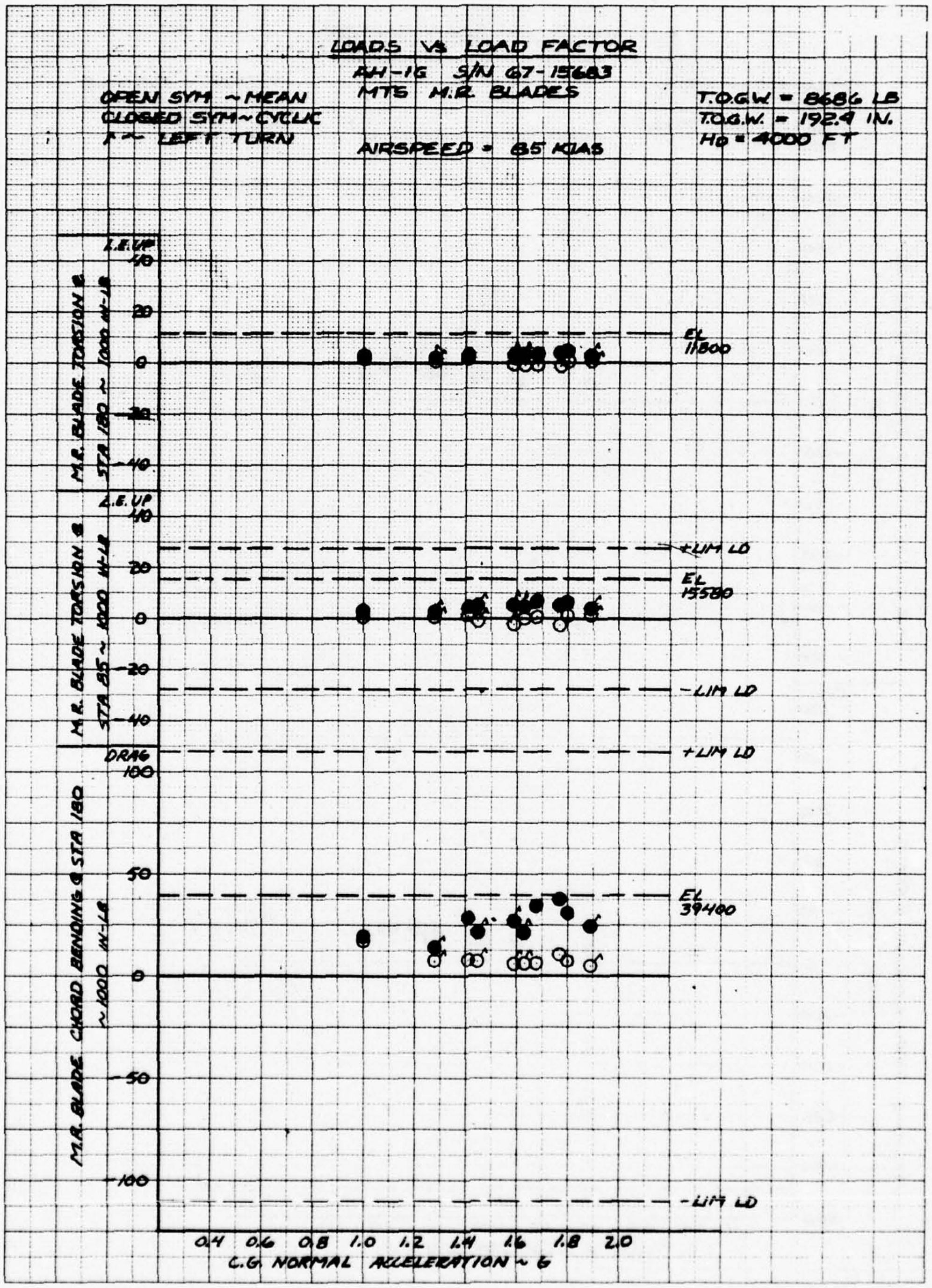


Figure E-2. Loads versus load factor - airspeed = 85 KIAS (Sheet 4 of 9).

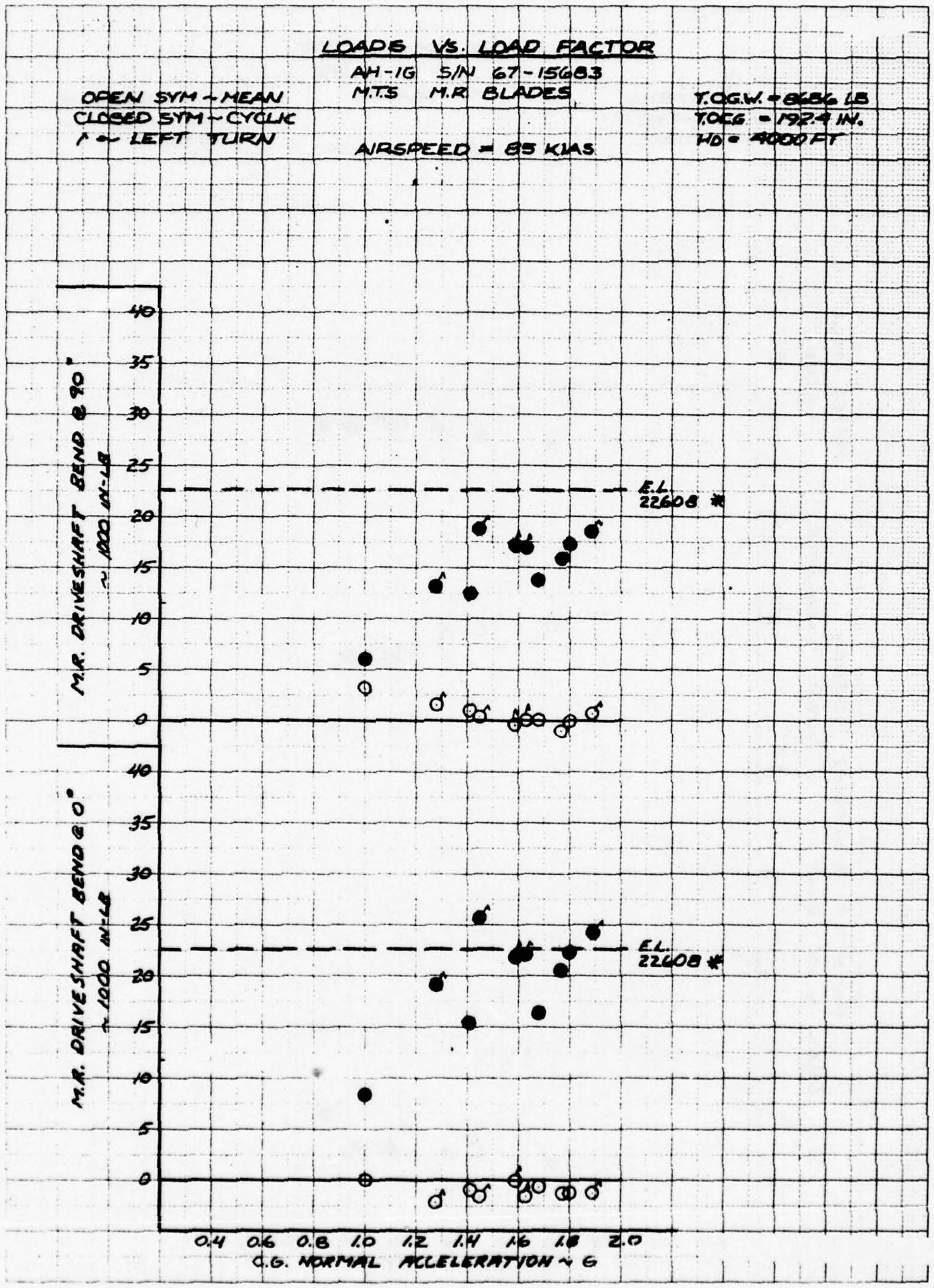


Figure E-2. Loads versus load factor - airspeed = 85 KIAS (Sheet 5 of 9).

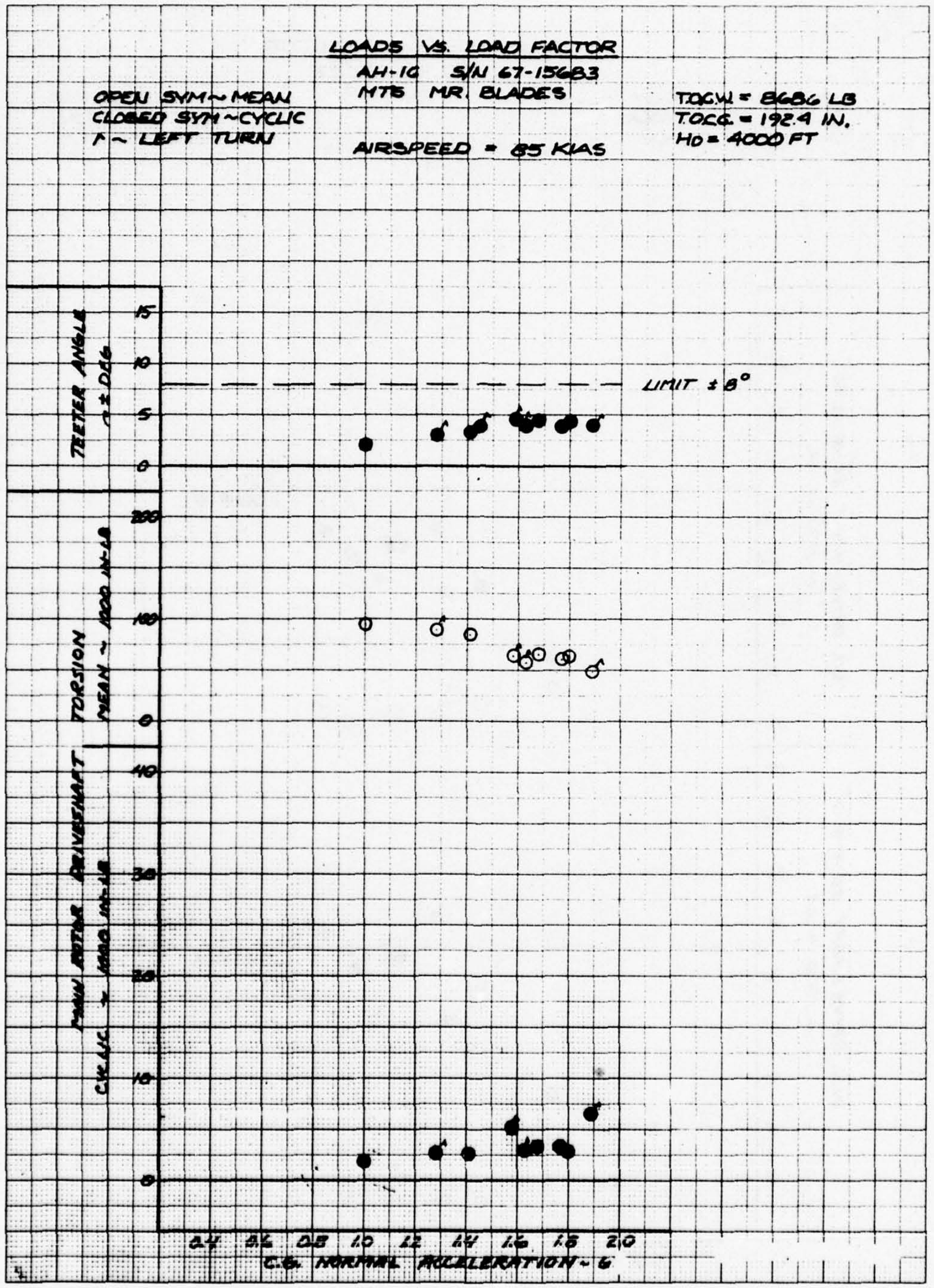


Figure E-2. Loads versus load factor - airspeed = 85 KIAS (Sheet 6 of 9).

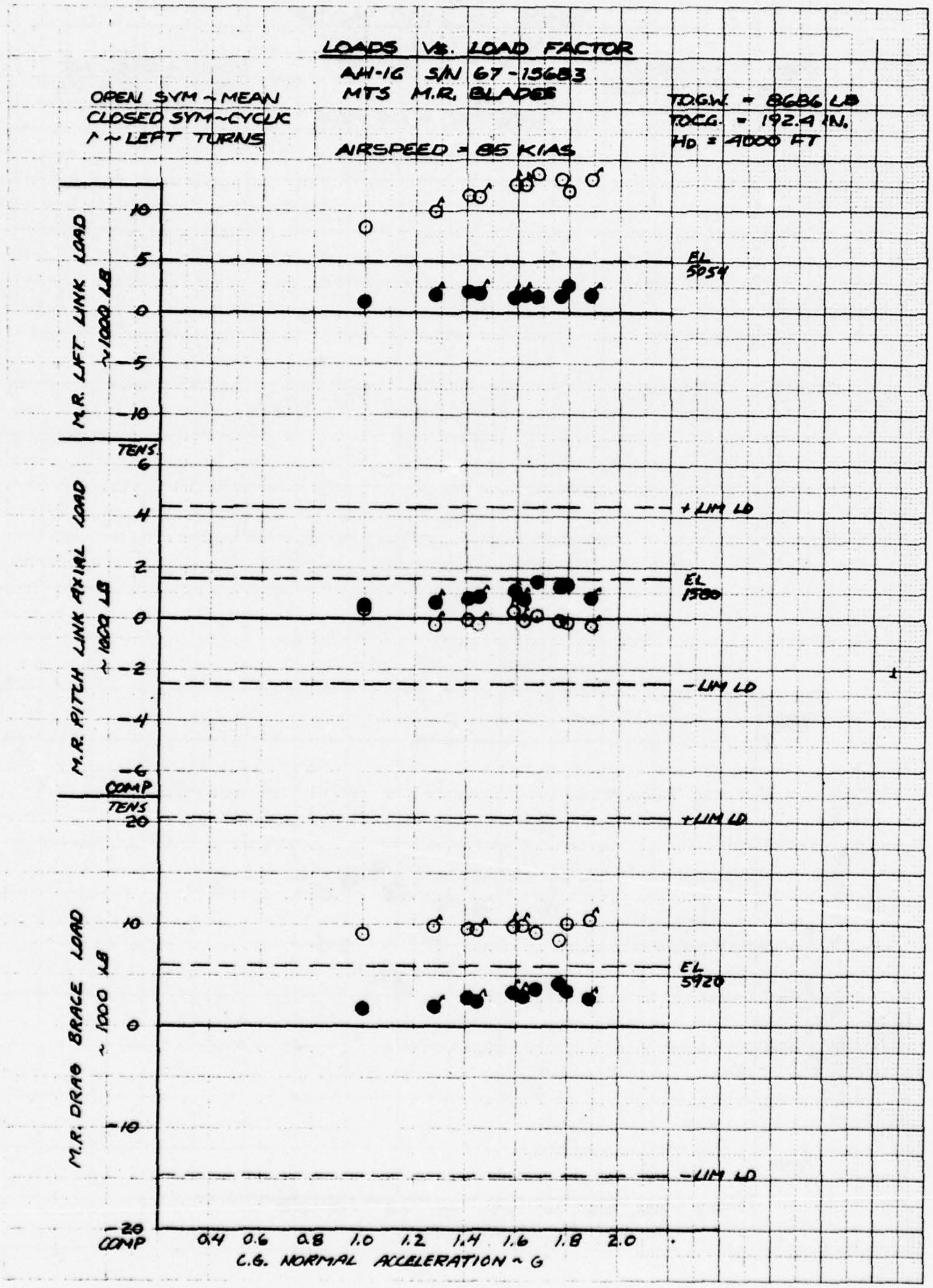


Figure E-2. Loads versus load factor - airspeed = 85 KIAS (Sheet 7 of 9).

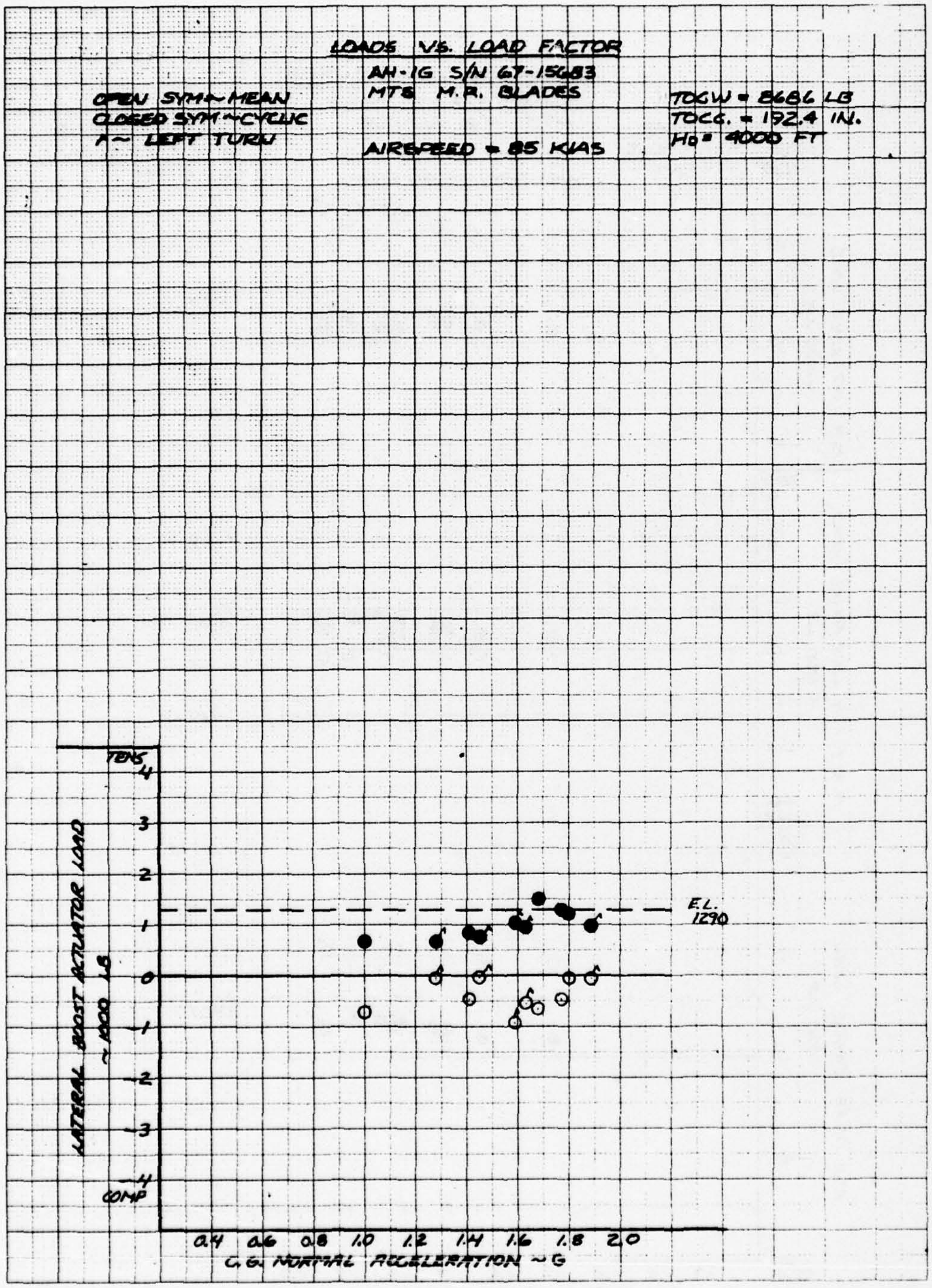


Figure E-2. Loads versus load factor – airspeed = 85 KIAS (Sheet 8 of 9).

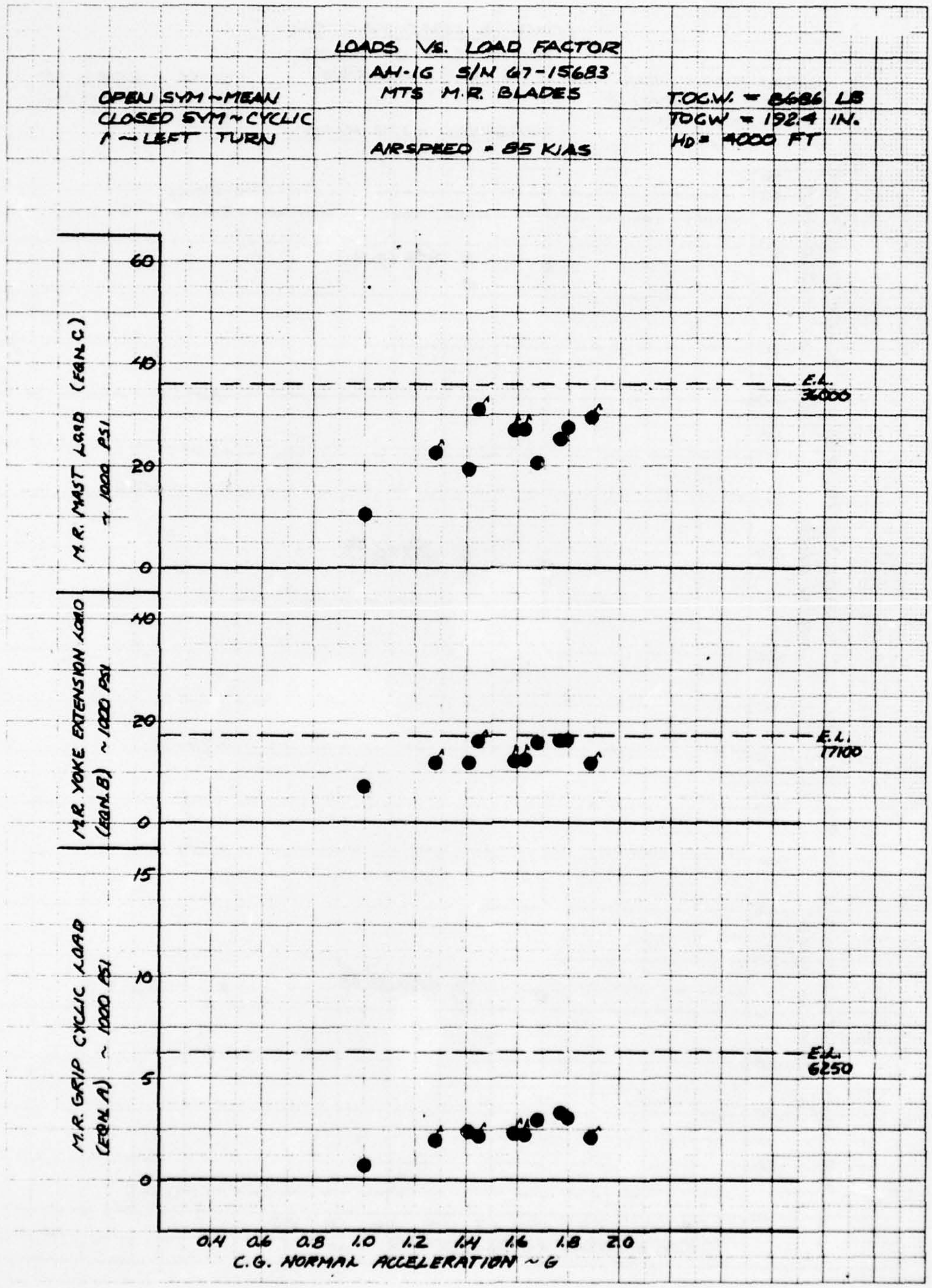


Figure E-2. Loads versus load factor - airspeed = 85 KIAS (Sheet 9 of 9).

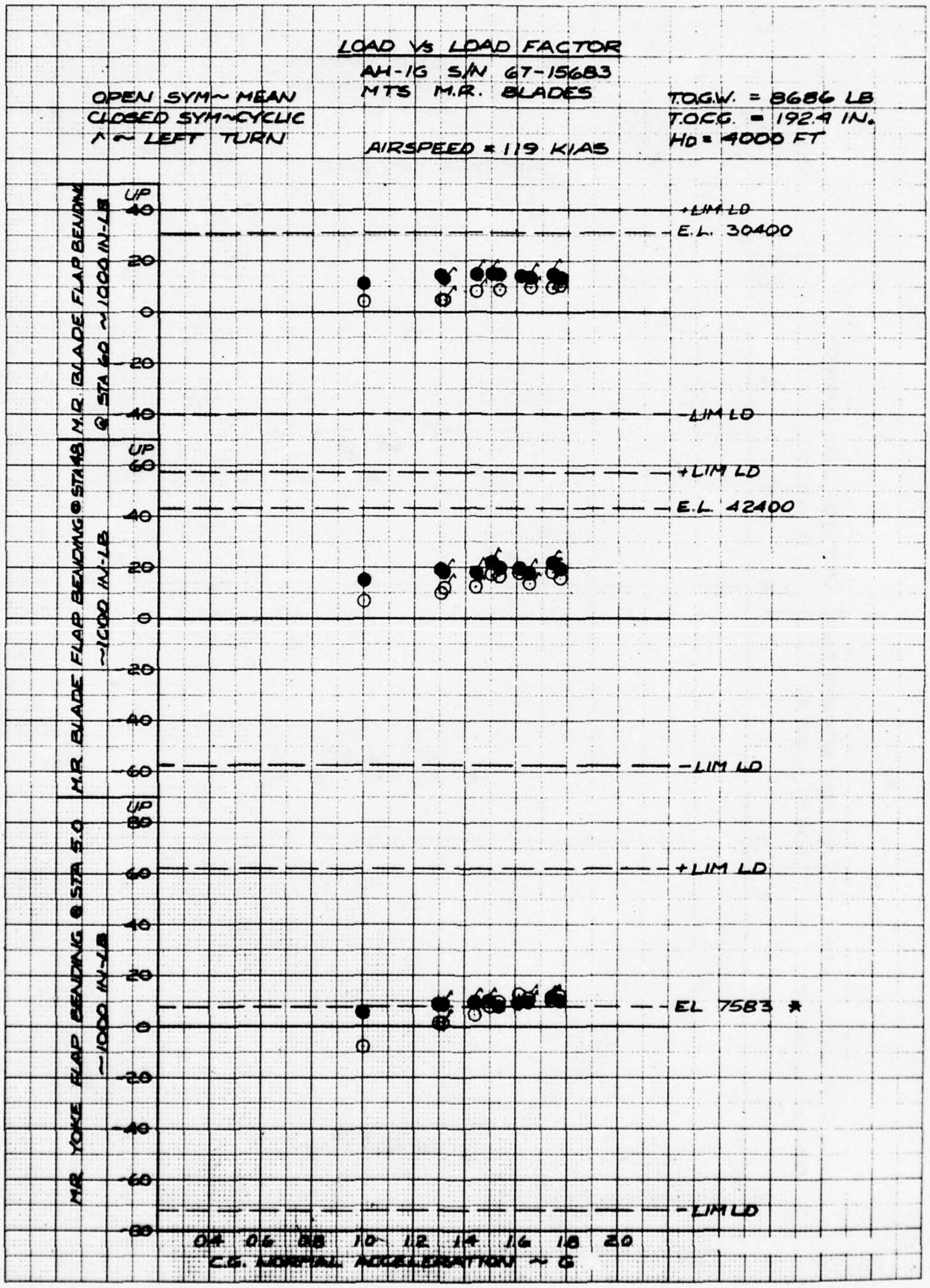


Figure E-3. Loads versus load factor - airspeed = 119 KIAS (Sheet 1 of 9).

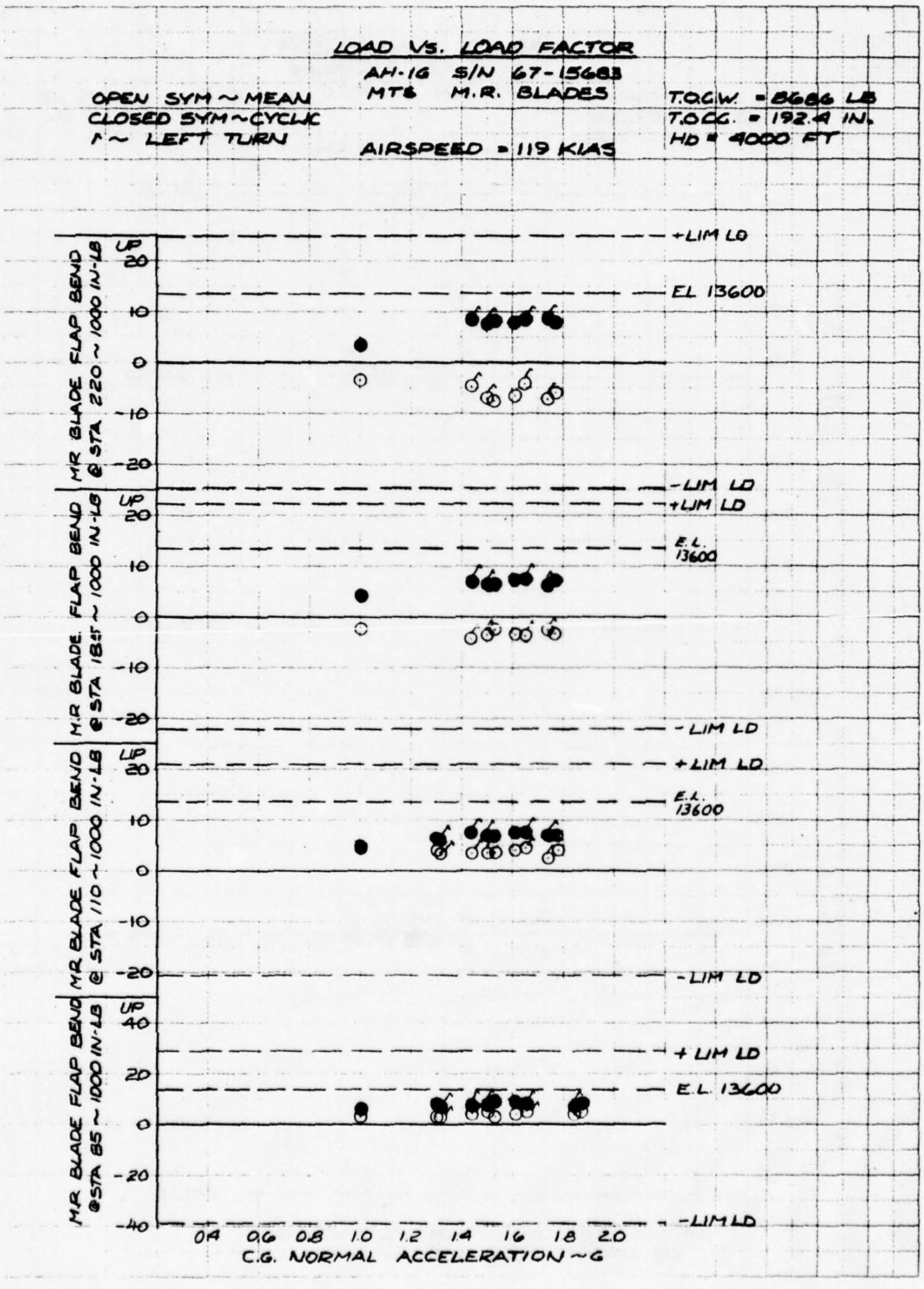


Figure E-3. Loads versus load factor - airspeed = 119 KIAS (Sheet 2 of 9).

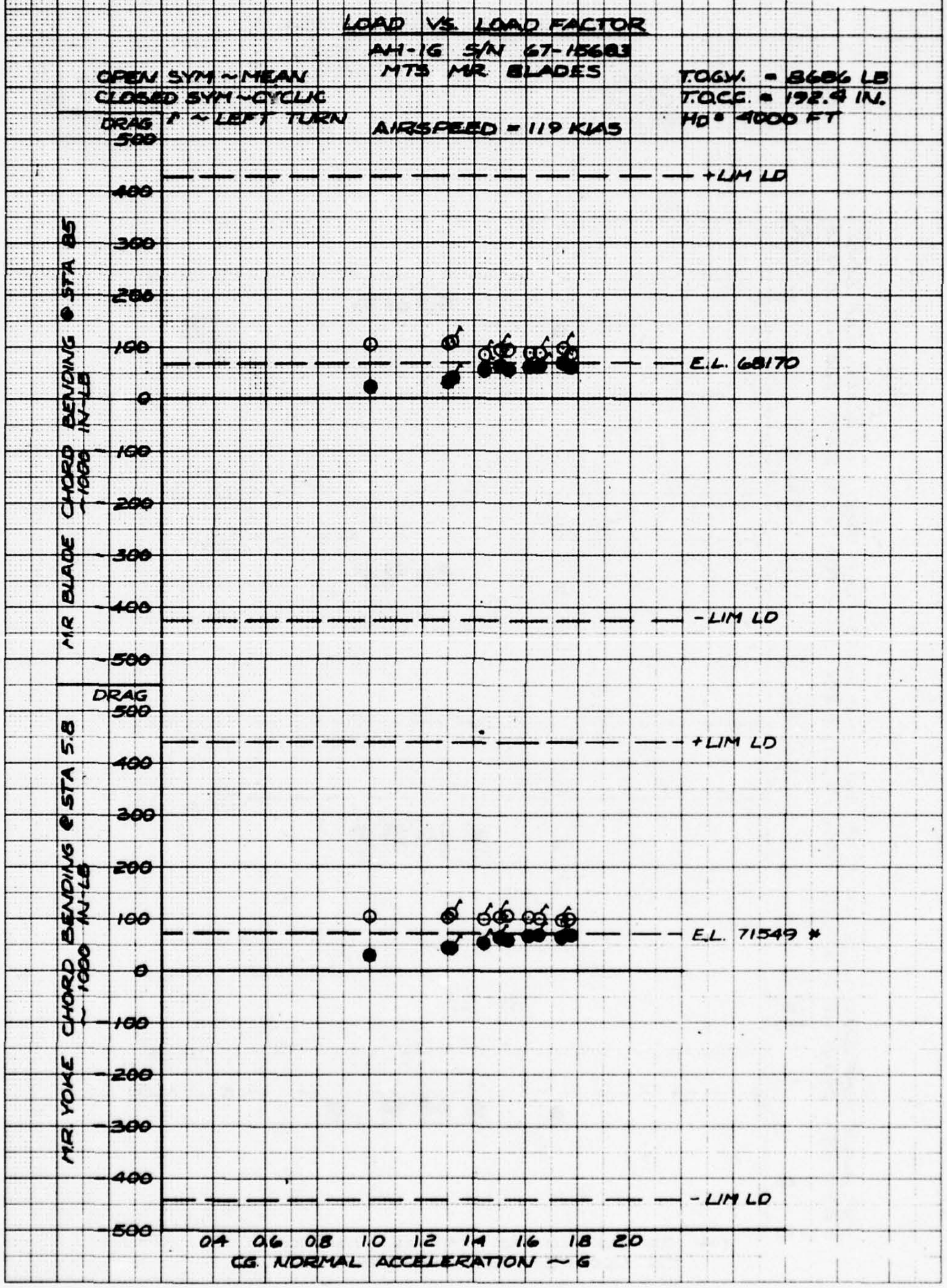


Figure E-3. Loads versus load factor - airspeed = 119 KIAS (Sheet 3 of 9).

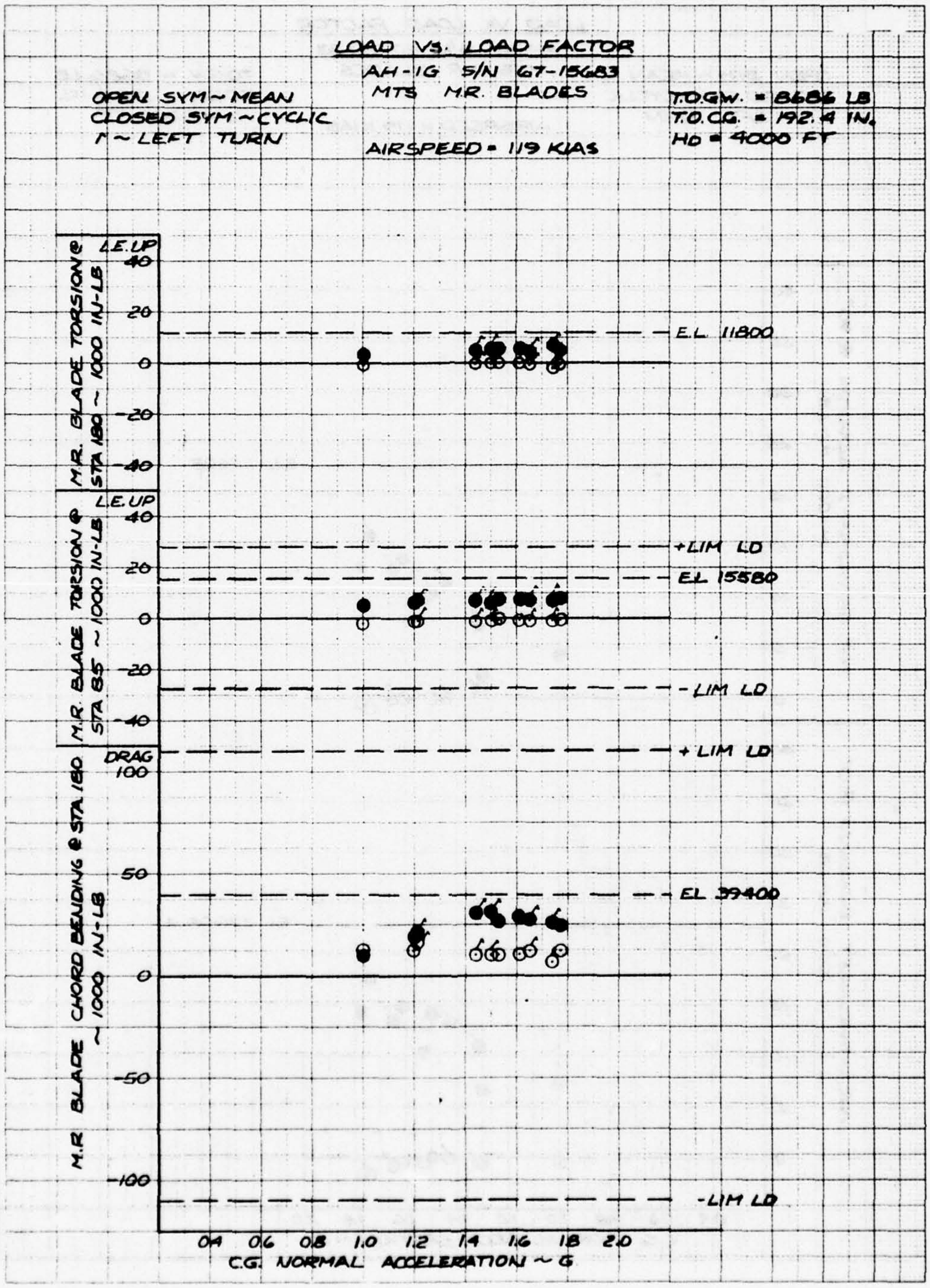


Figure E-3. Loads versus load factor - airspeed = 119 KIAS (Sheet 4 of 9).

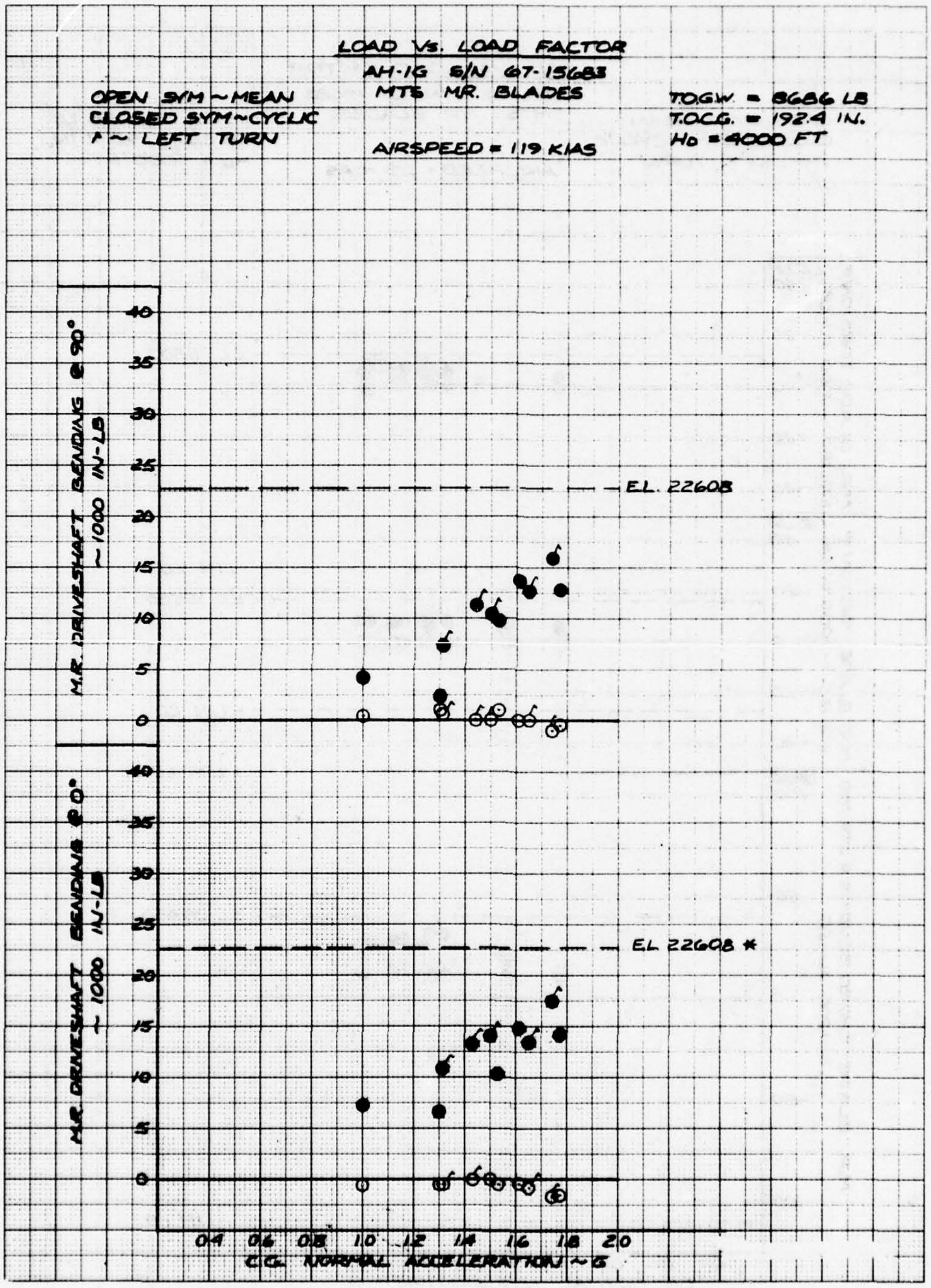


Figure E-3. Loads versus load factor - airspeed = 119 KIAS (Sheet 5 of 9).

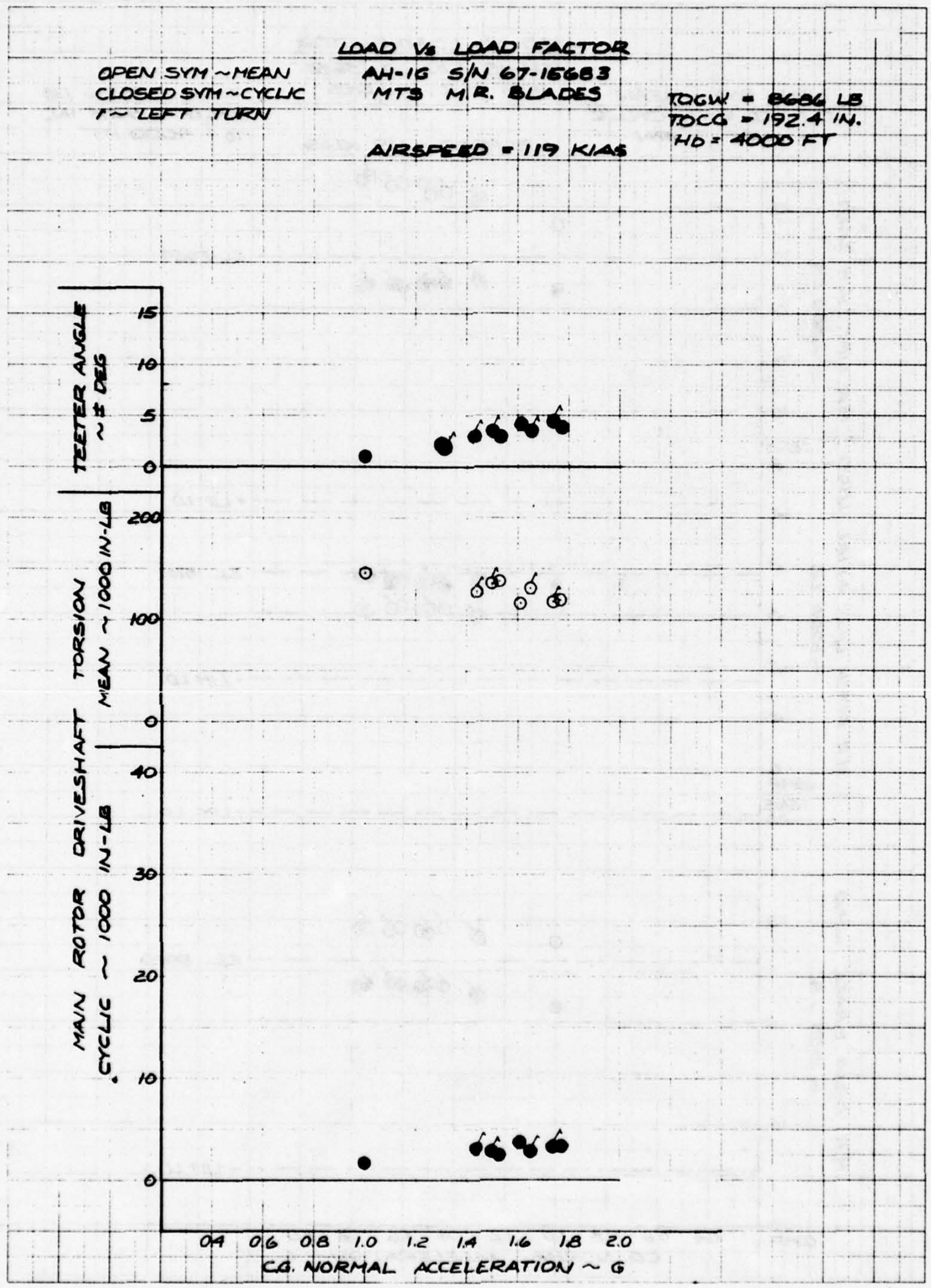


Figure E-3. Loads versus load factor - airspeed = 119 KIAS (Sheet 6 of 9).

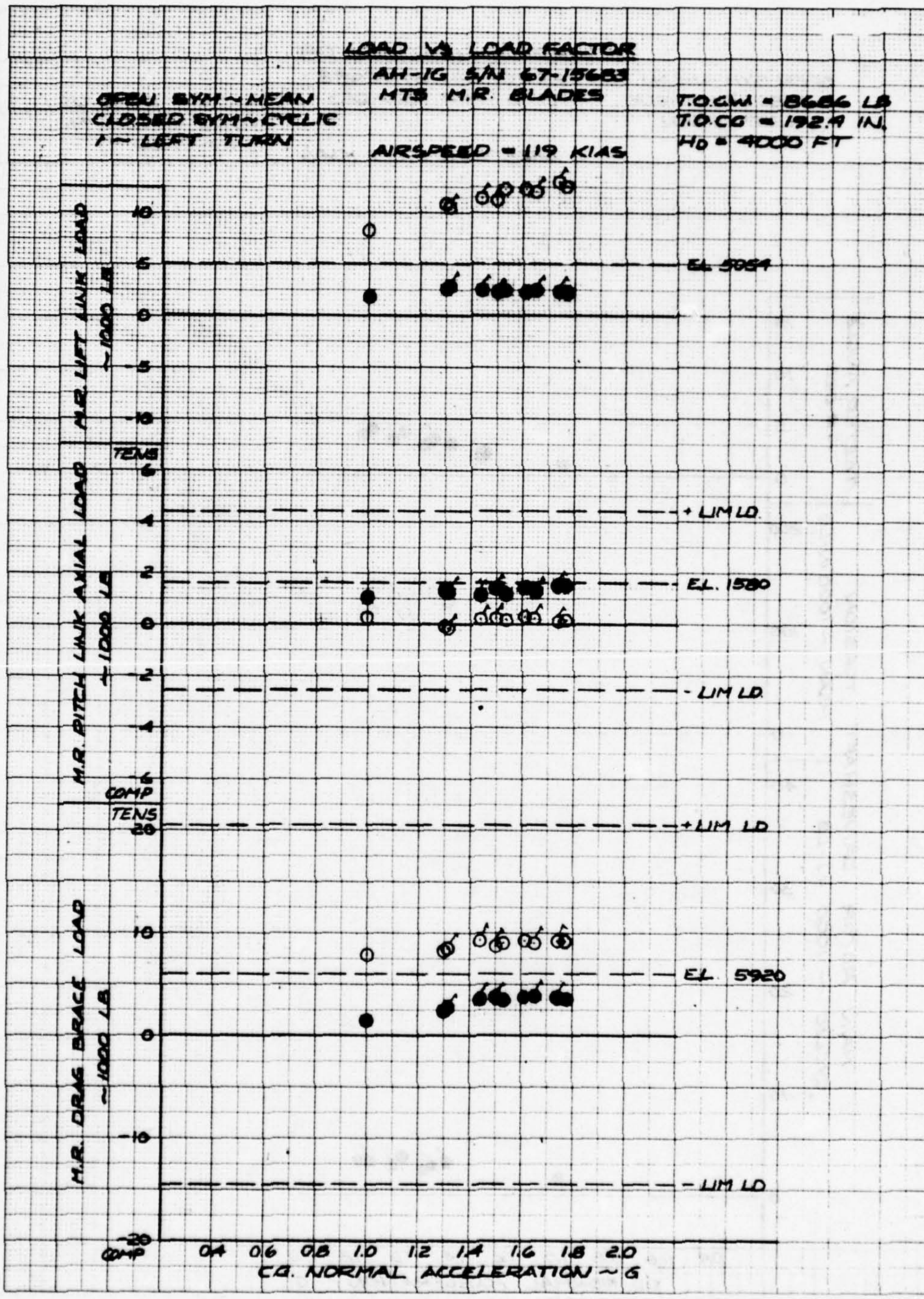


Figure E-3. Loads versus load factor - airspeed = 119 KIAS (Sheet 7 of 9).

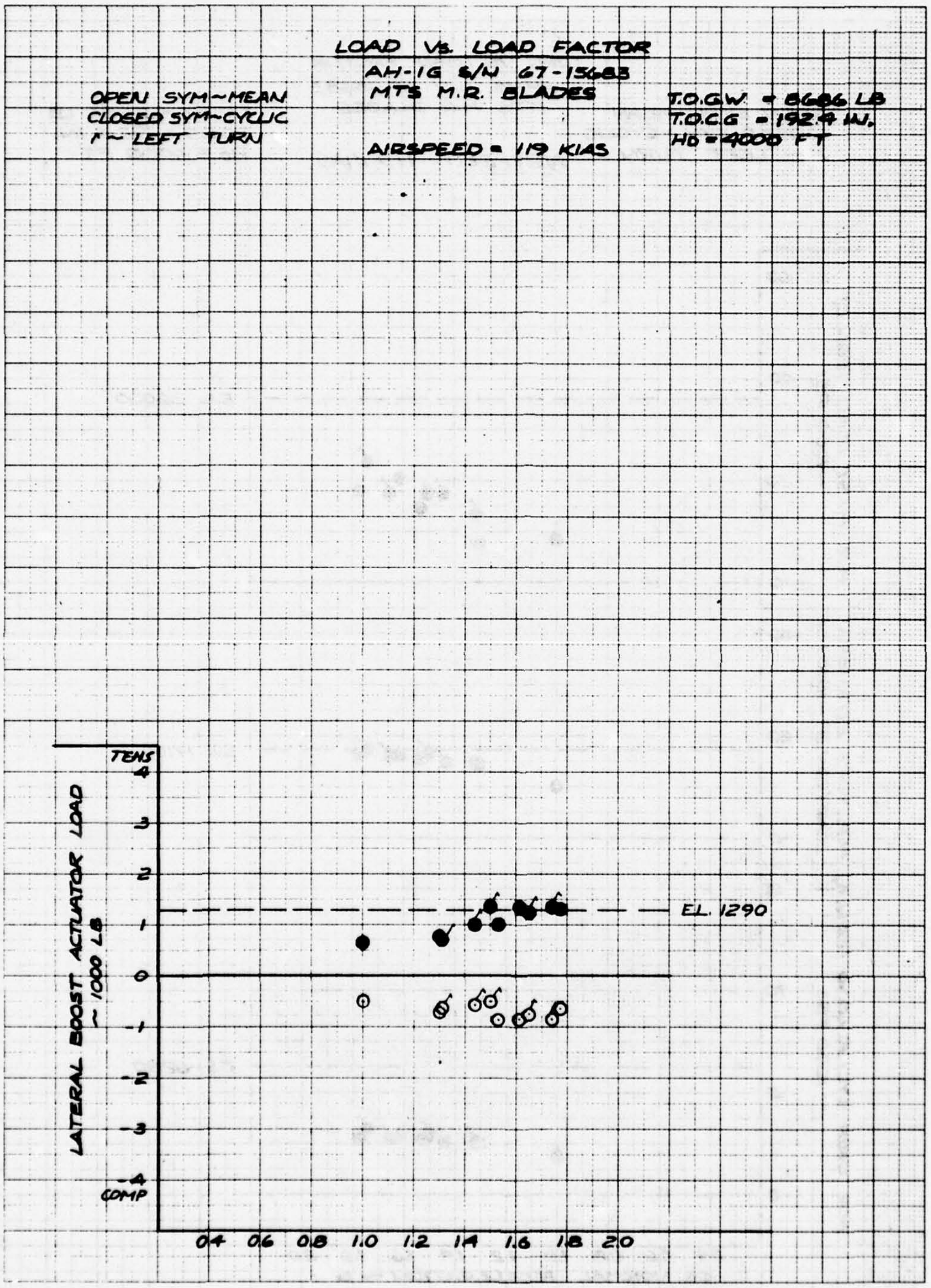


Figure E-3. Loads versus load factor - airspeed = 119 KIAS (Sheet 8 of 9).

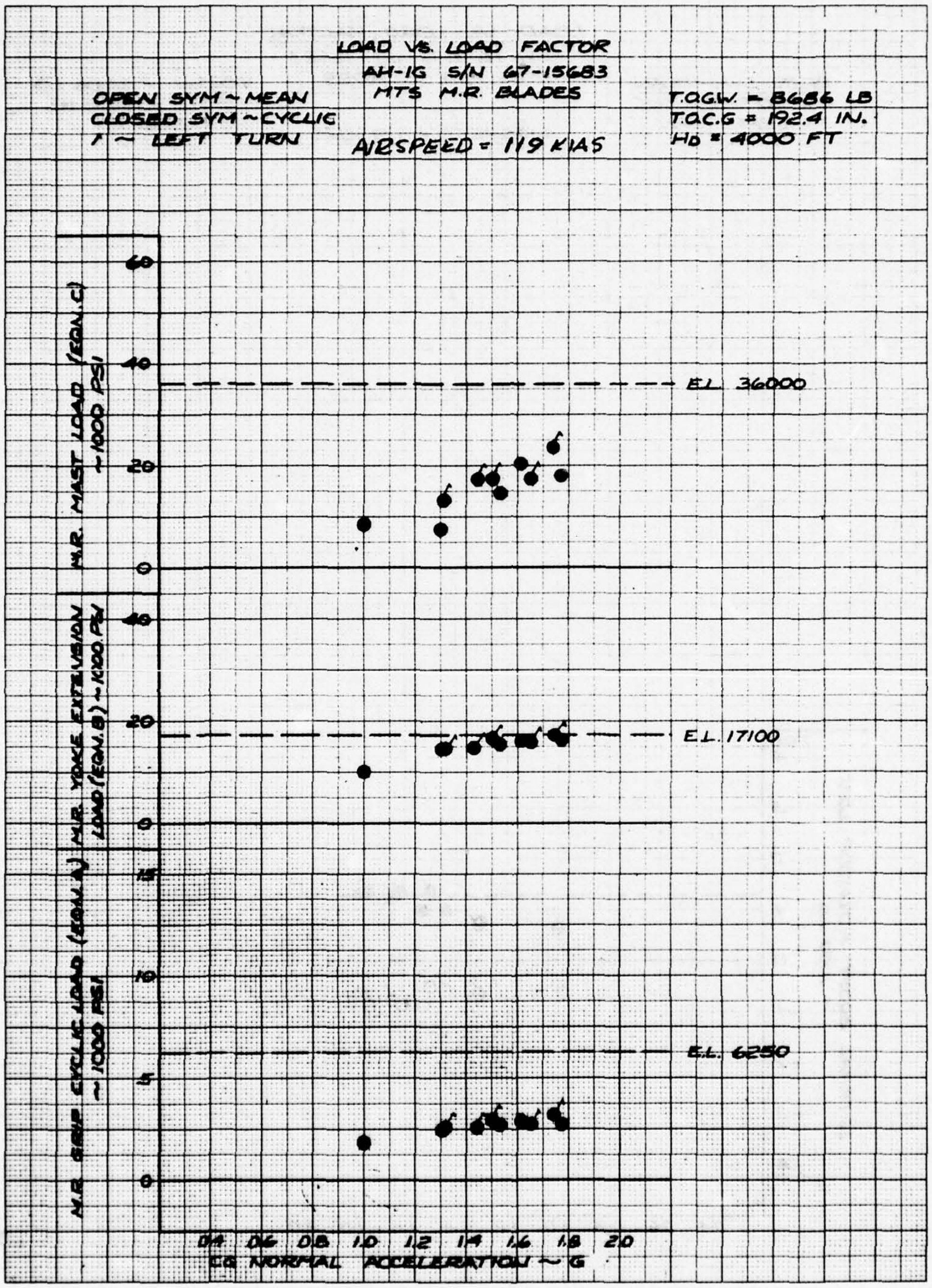


Figure E-3. Loads versus load factor – airspeed = 119 KIAS (Sheet 9 of 9).

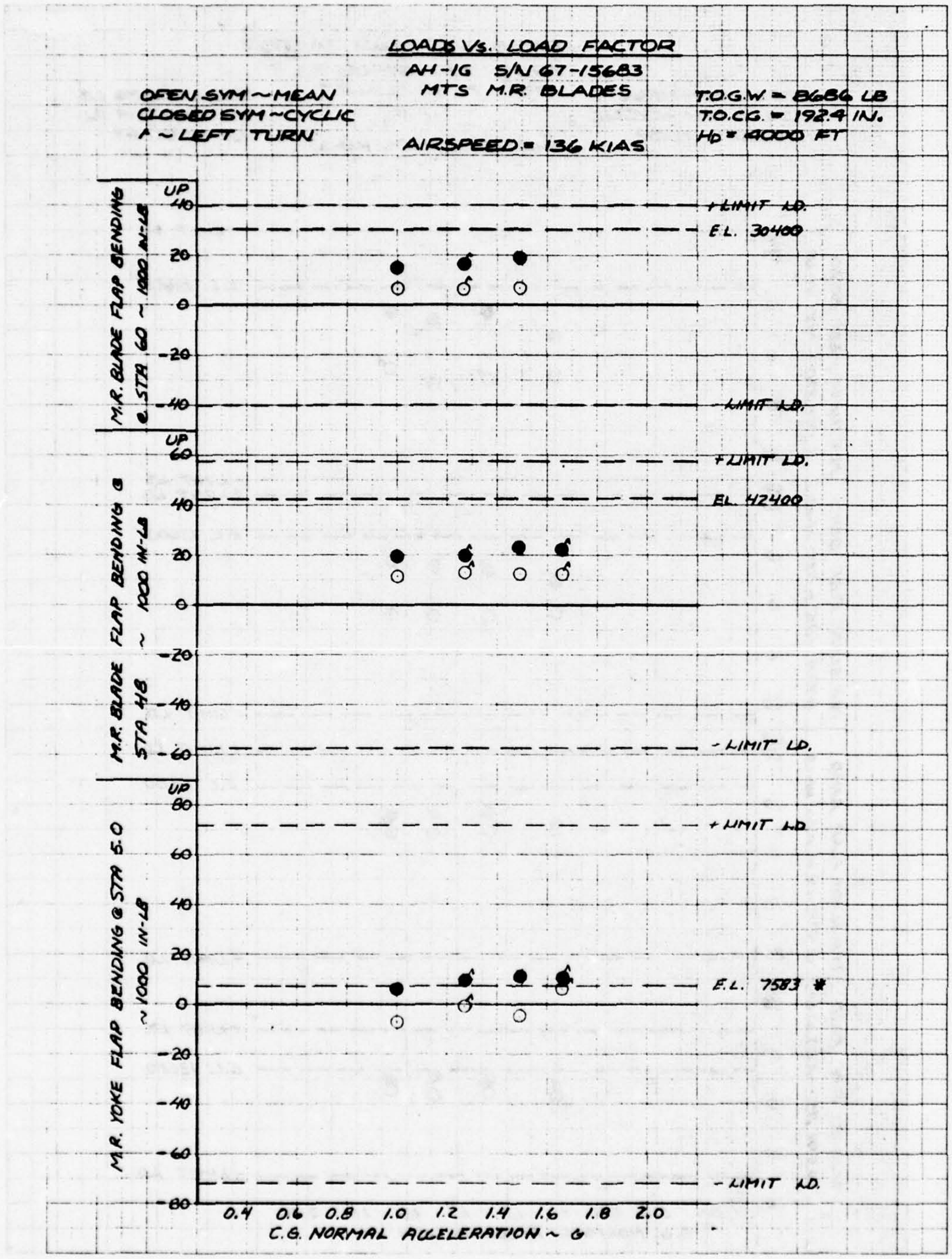


Figure E-4. Loads versus load factor - airspeed = 136 KIAS (Sheet 1 of 9).

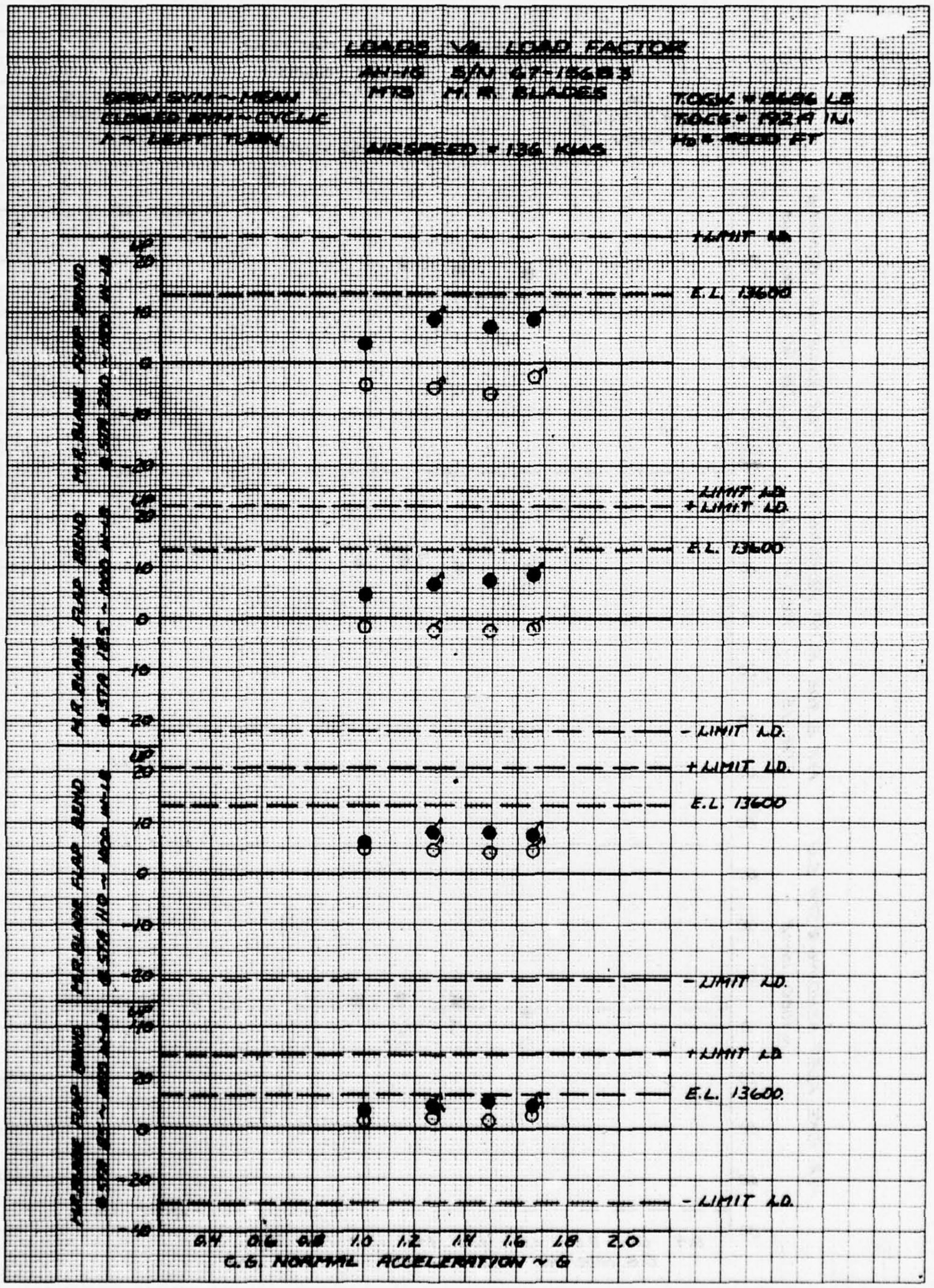


Figure E-4. Loads versus load factor - airspeed = 136 KIAS (Sheet 2 of 9).

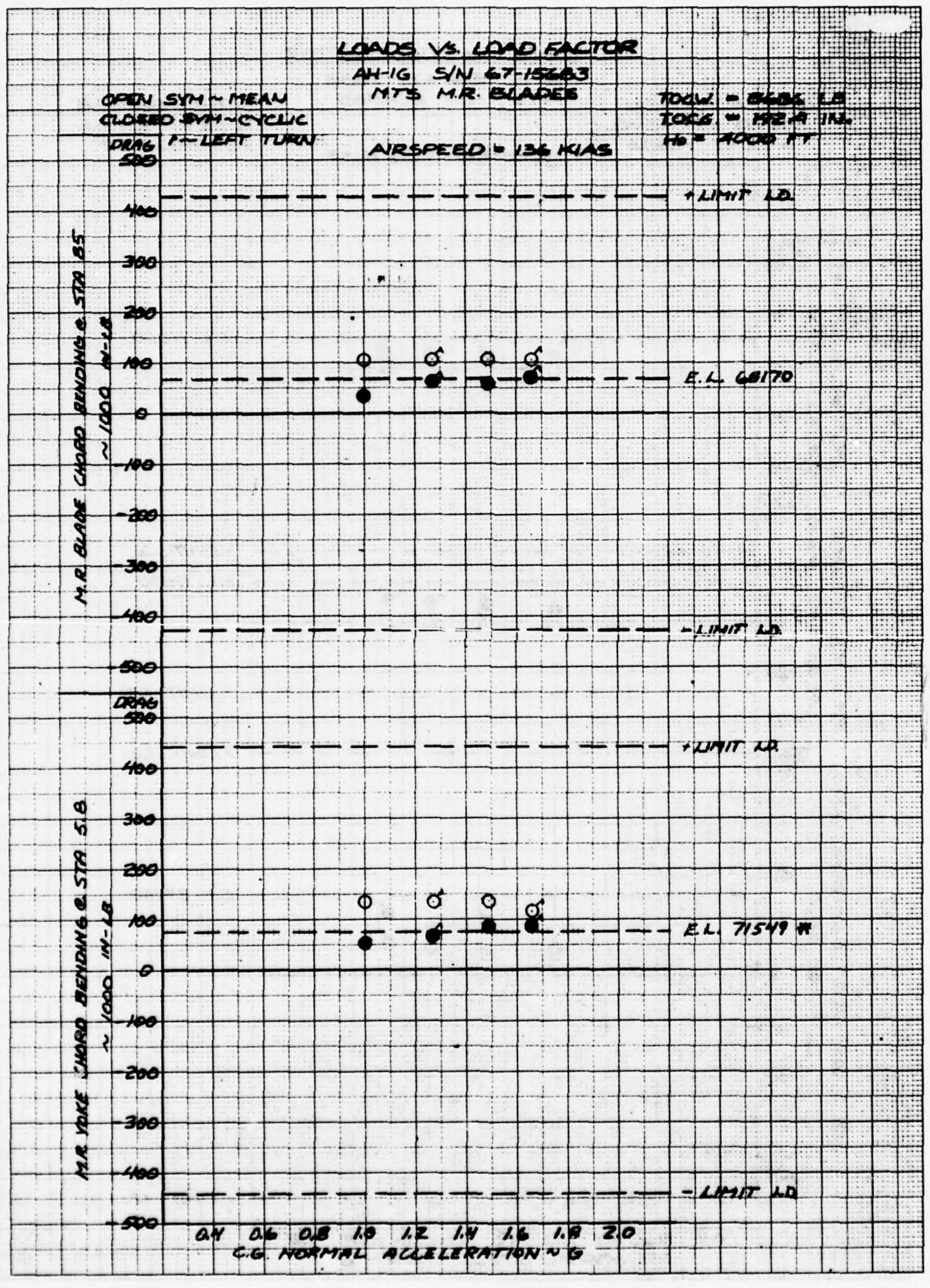


Figure E-4. Loads versus load factor - airspeed = 136 KIAS (Sheet 3 of 9).

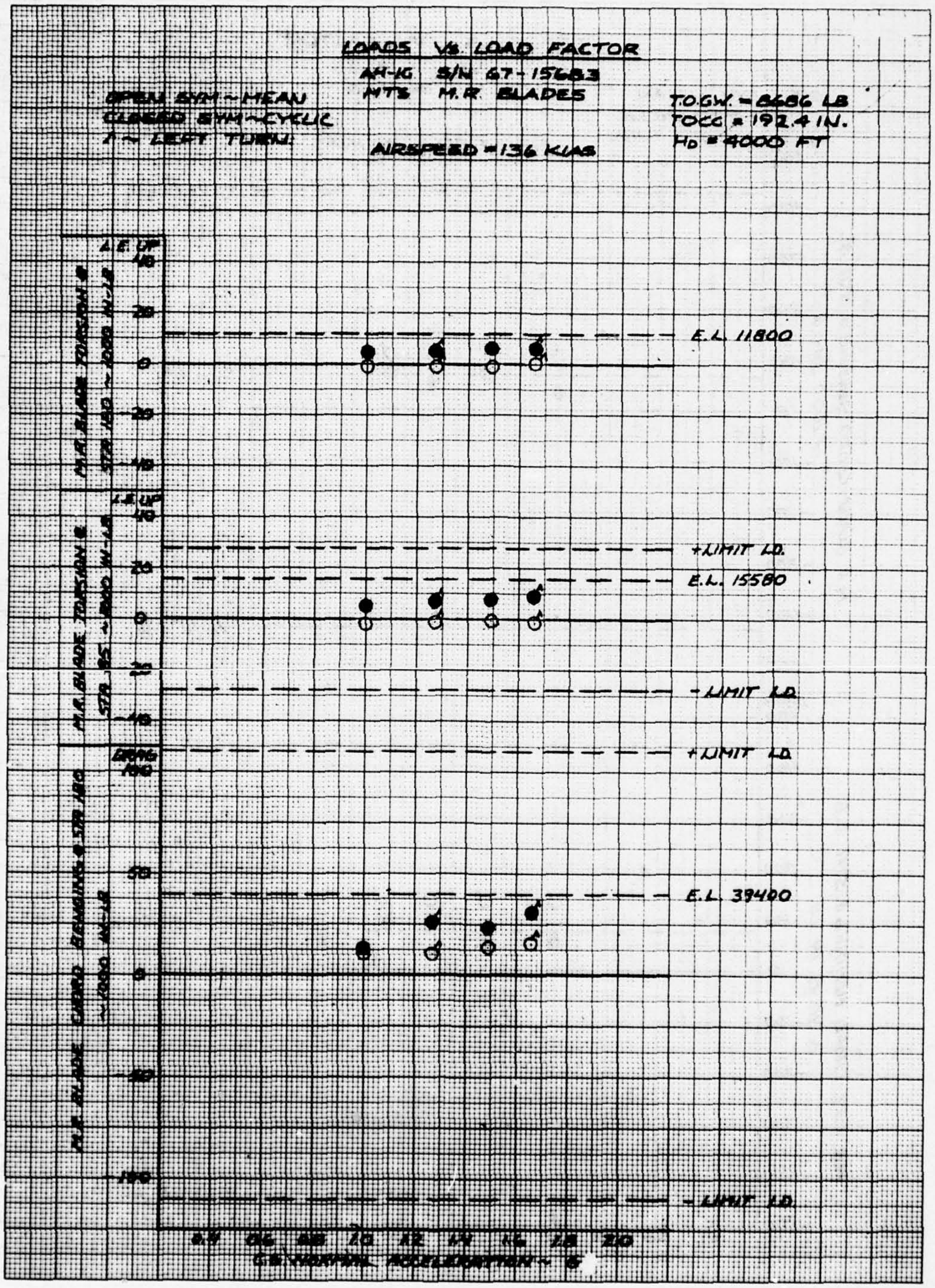


Figure E-4. Loads versus load factor - airspeed = 136 KIAS (Sheet 4 of 9).

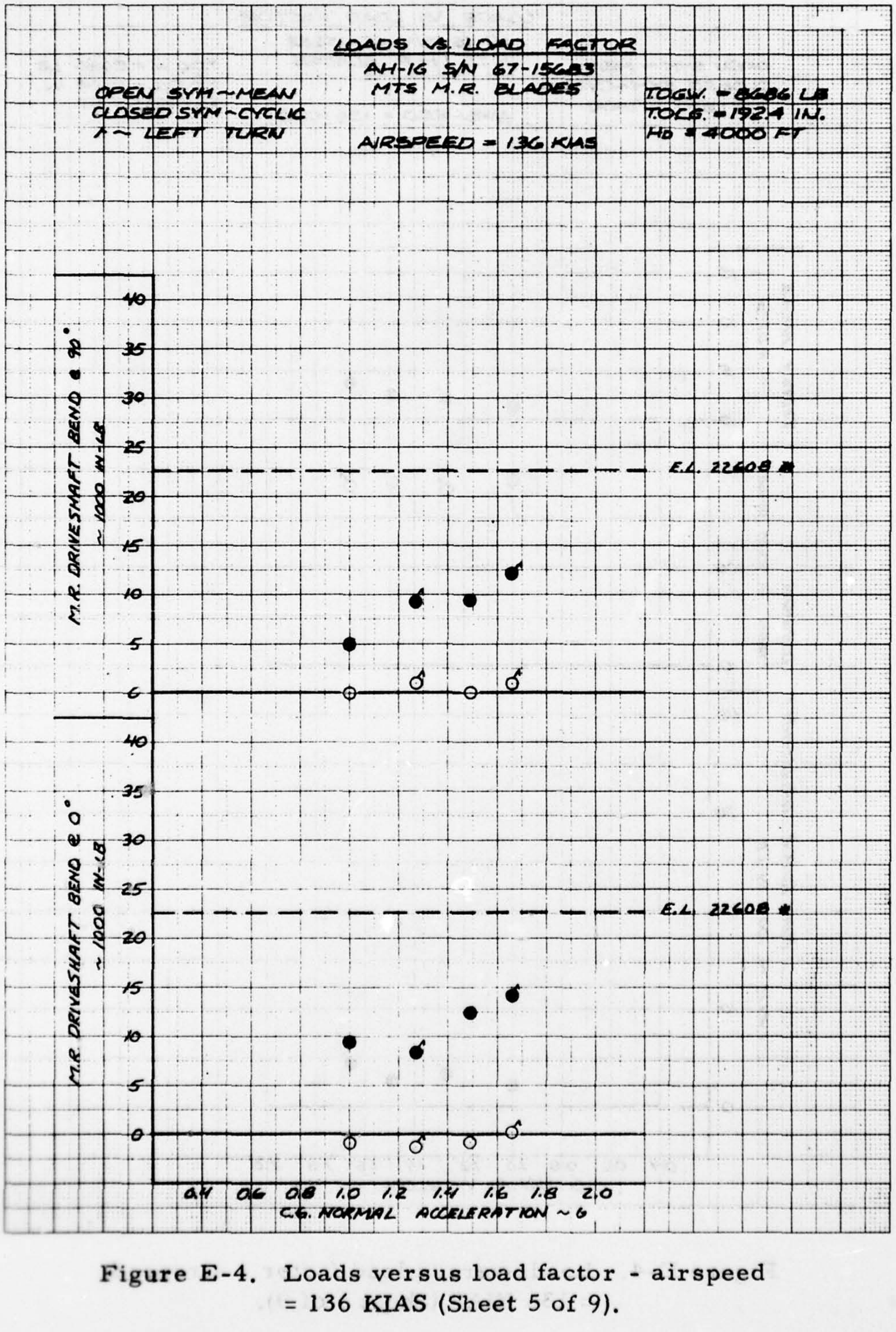


Figure E-4. Loads versus load factor - airspeed = 136 KIAS (Sheet 5 of 9).

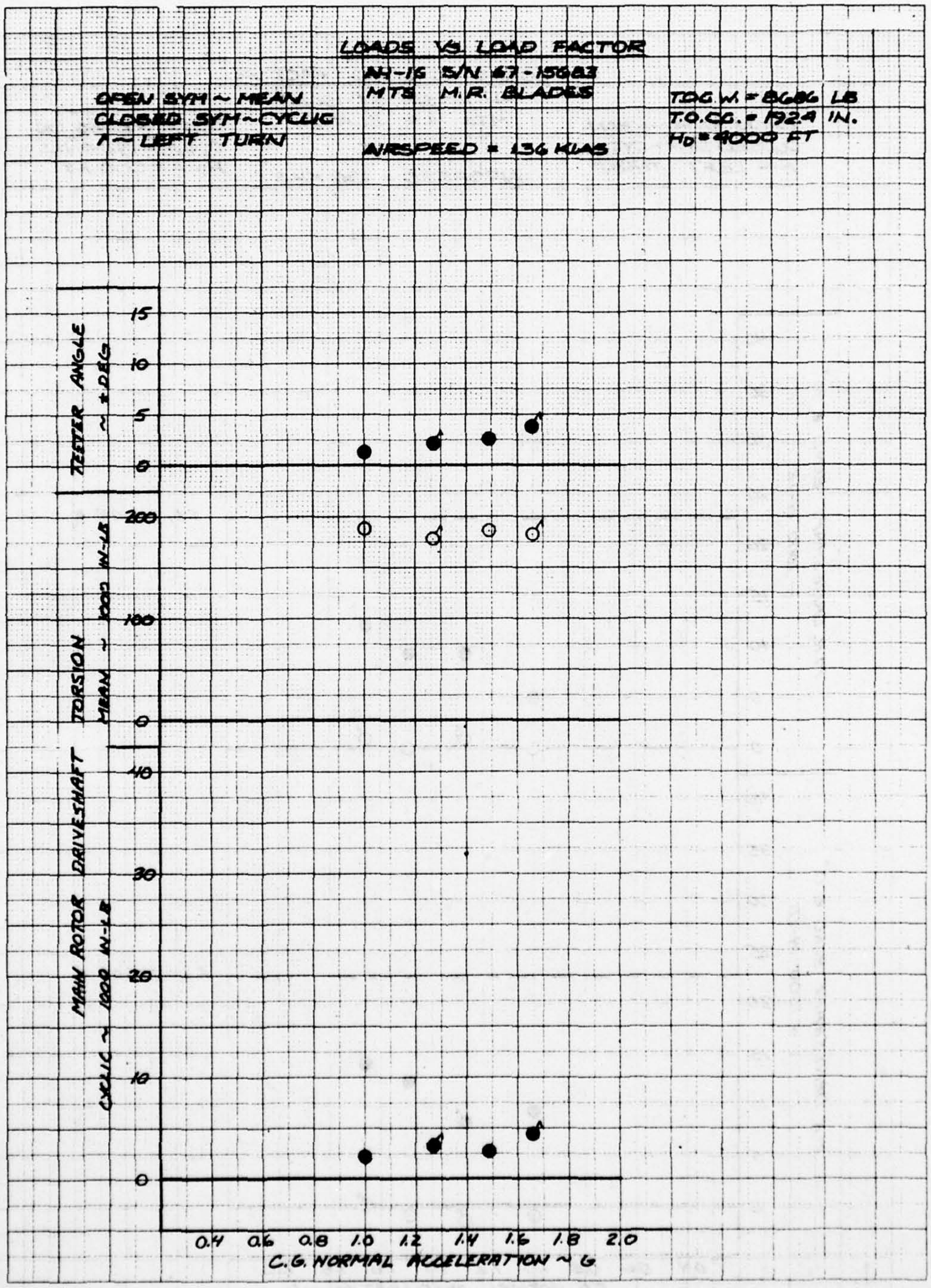


Figure E-4. Loads versus load factor - airspeed = 136 KIAS (Sheet 6 of 9).

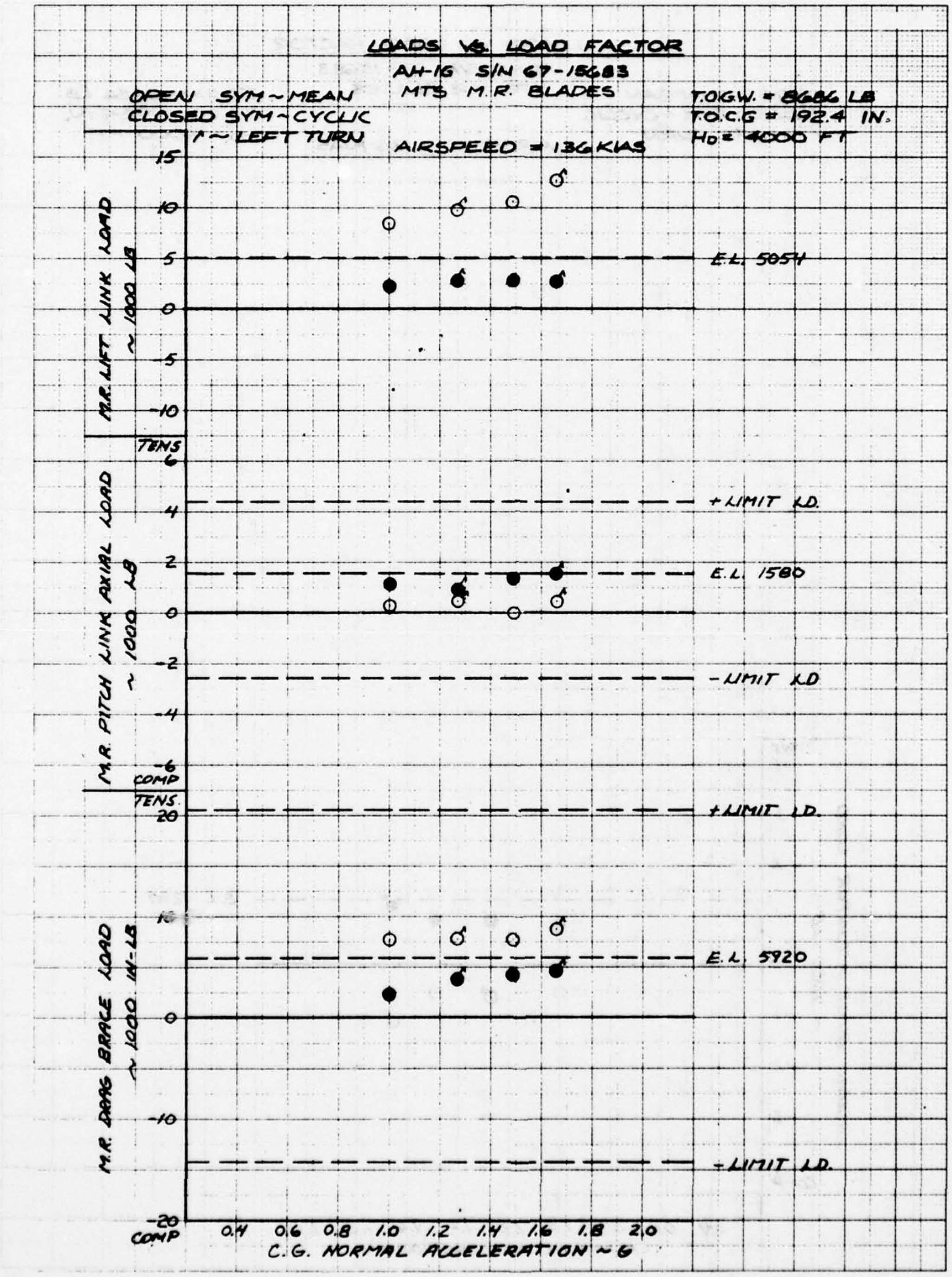


Figure E-4. Loads versus load factor - airspeed = 136 KIAS (Sheet 7 of 9).

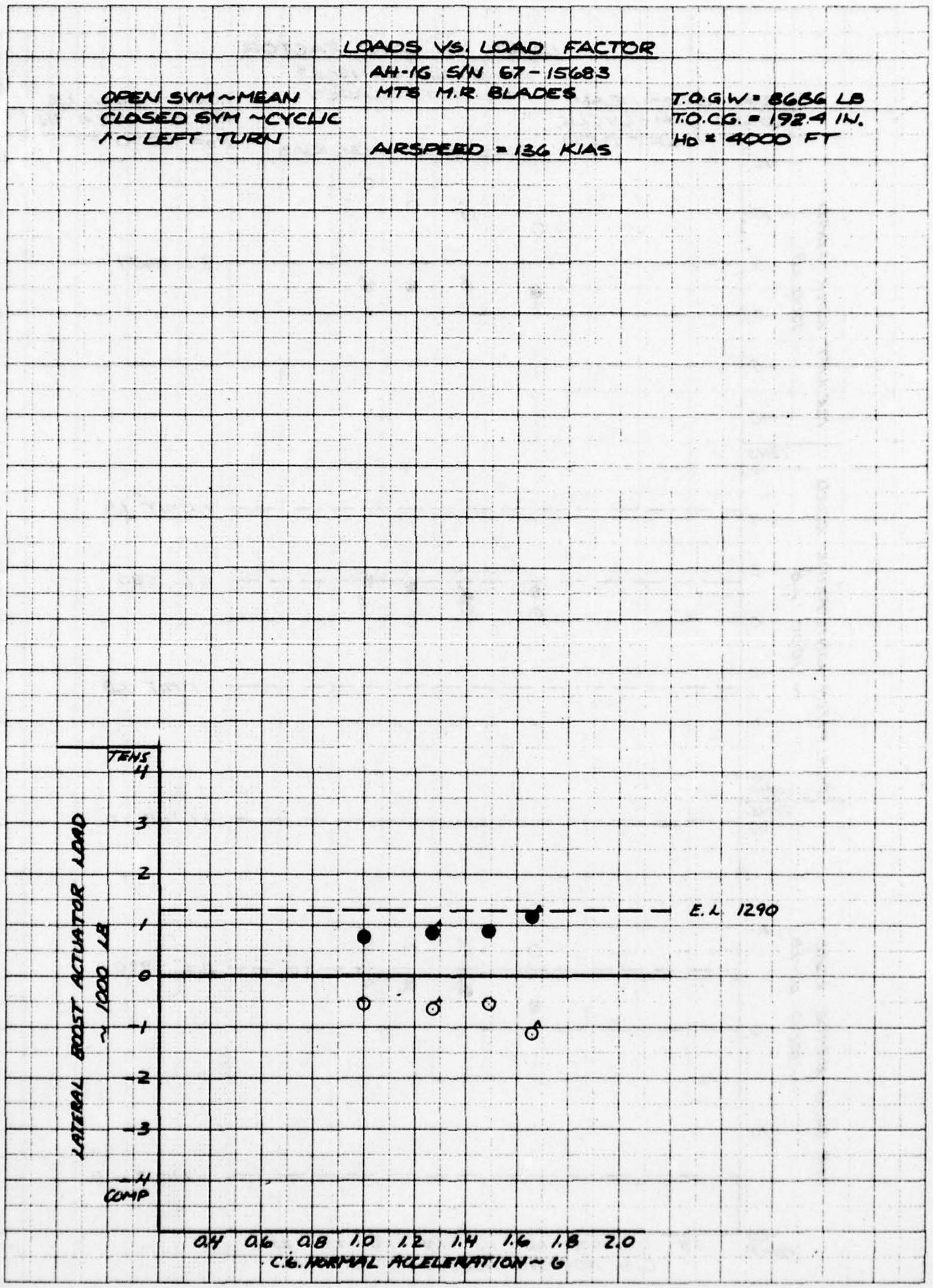


Figure E-4. Loads versus load factor - airspeed = 136 KIAS (Sheet 8 of 9).

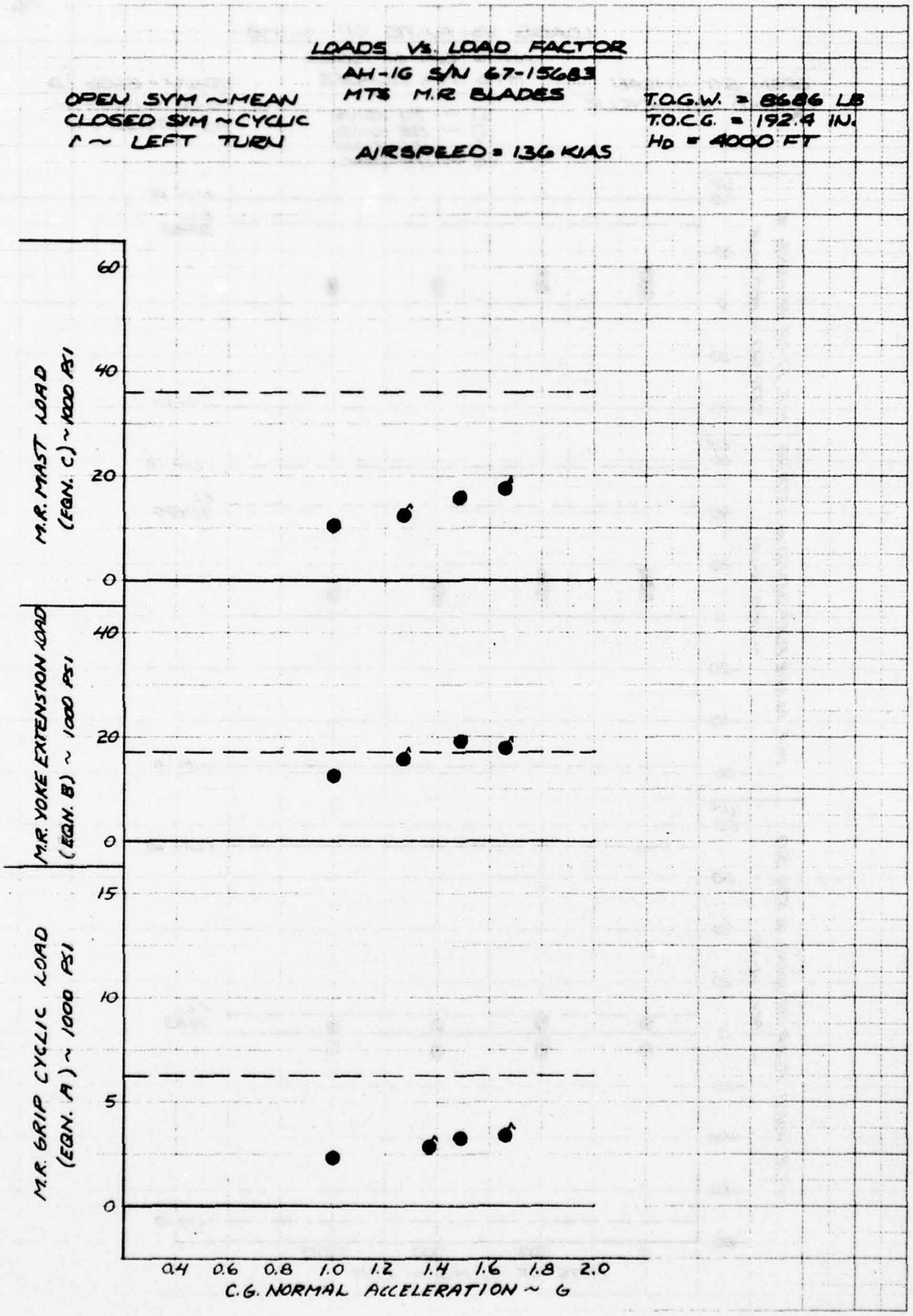


Figure E-4. Loads versus load factor - airspeed = 136 KIAS (Sheet 9 of 9).

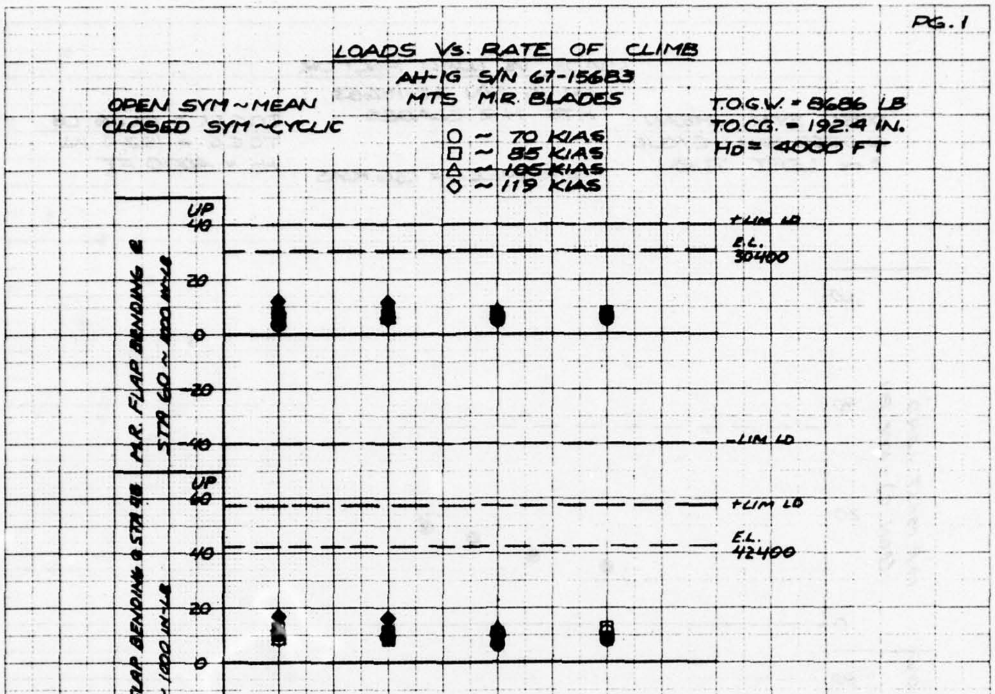


Figure E-5. Loads versus rate of climb (Sheet 1 of 8).

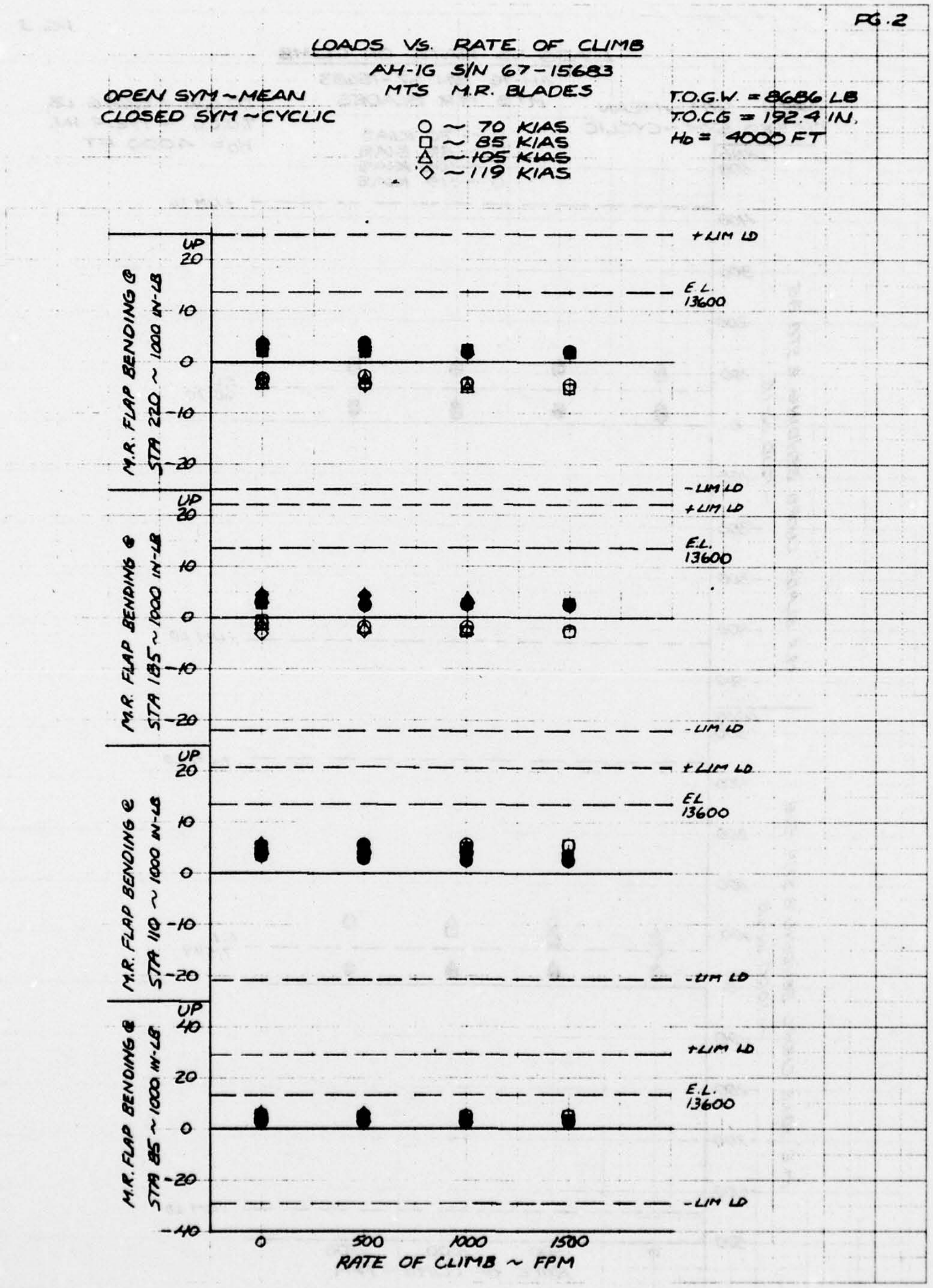


Figure E-5. Loads versus rate of climb (Sheet 2 of 8).

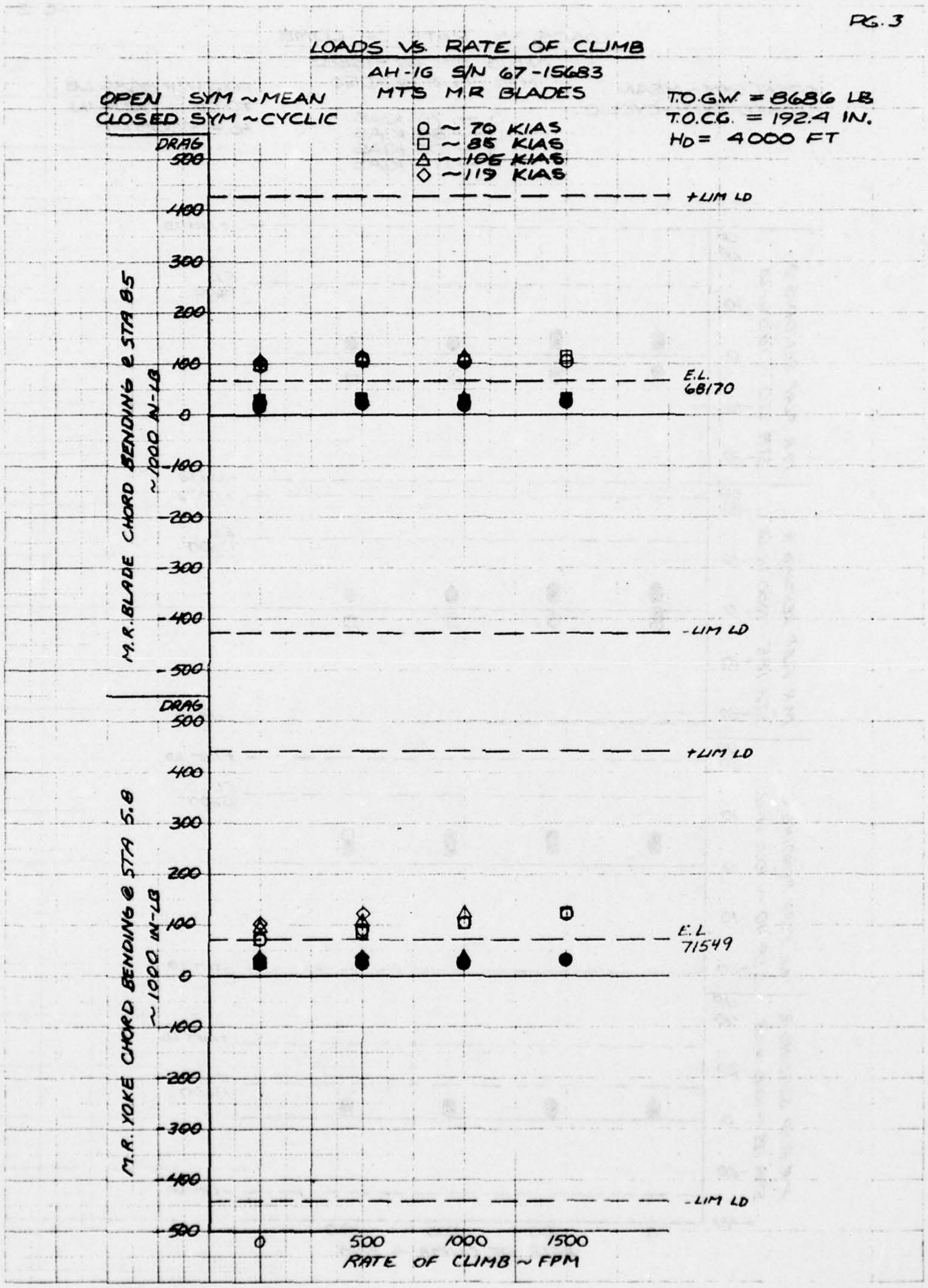


Figure E-5. Loads versus rate of climb (Sheet 3 of 8).

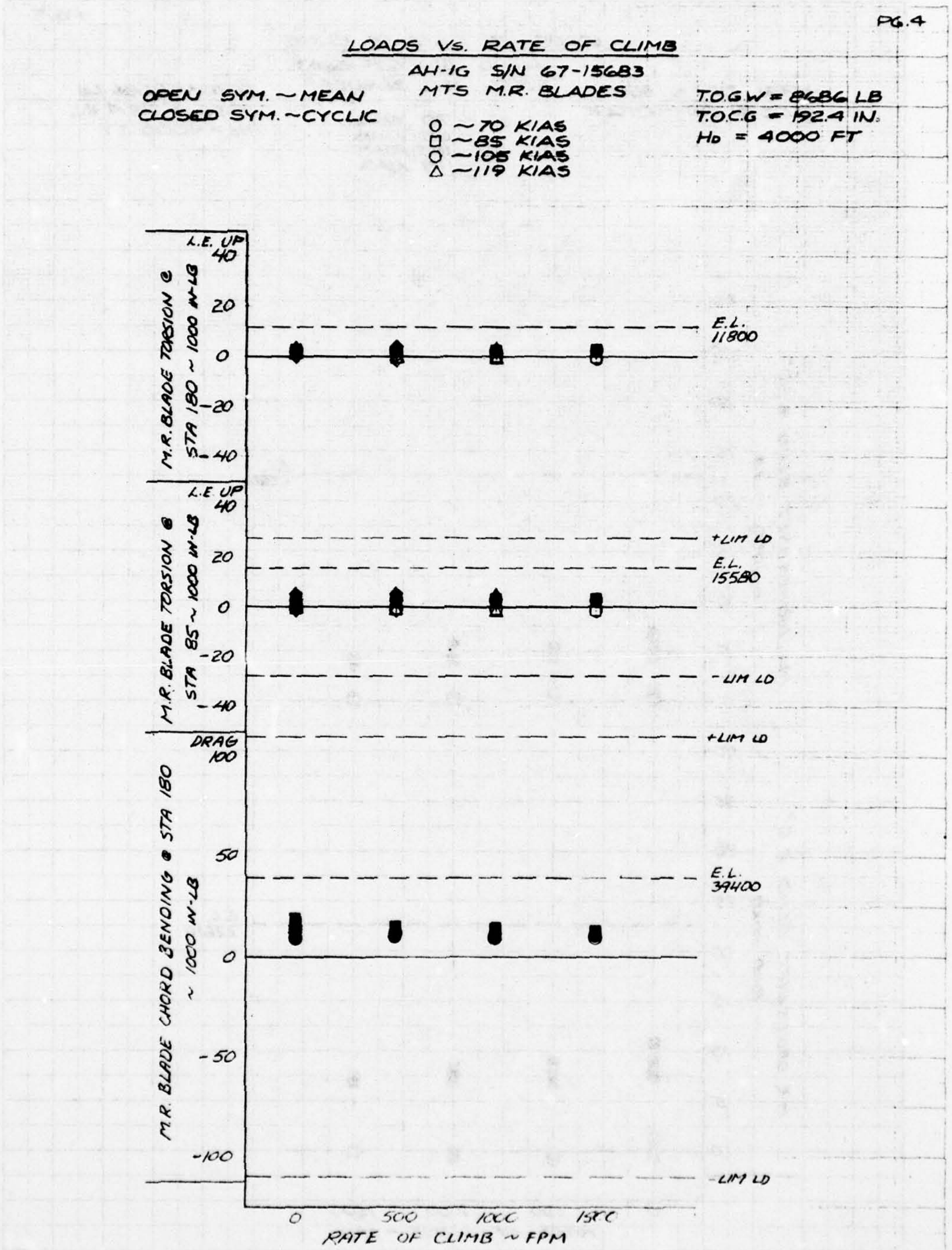


Figure E-5. Loads versus rate of climb (Sheet 4 of 8).

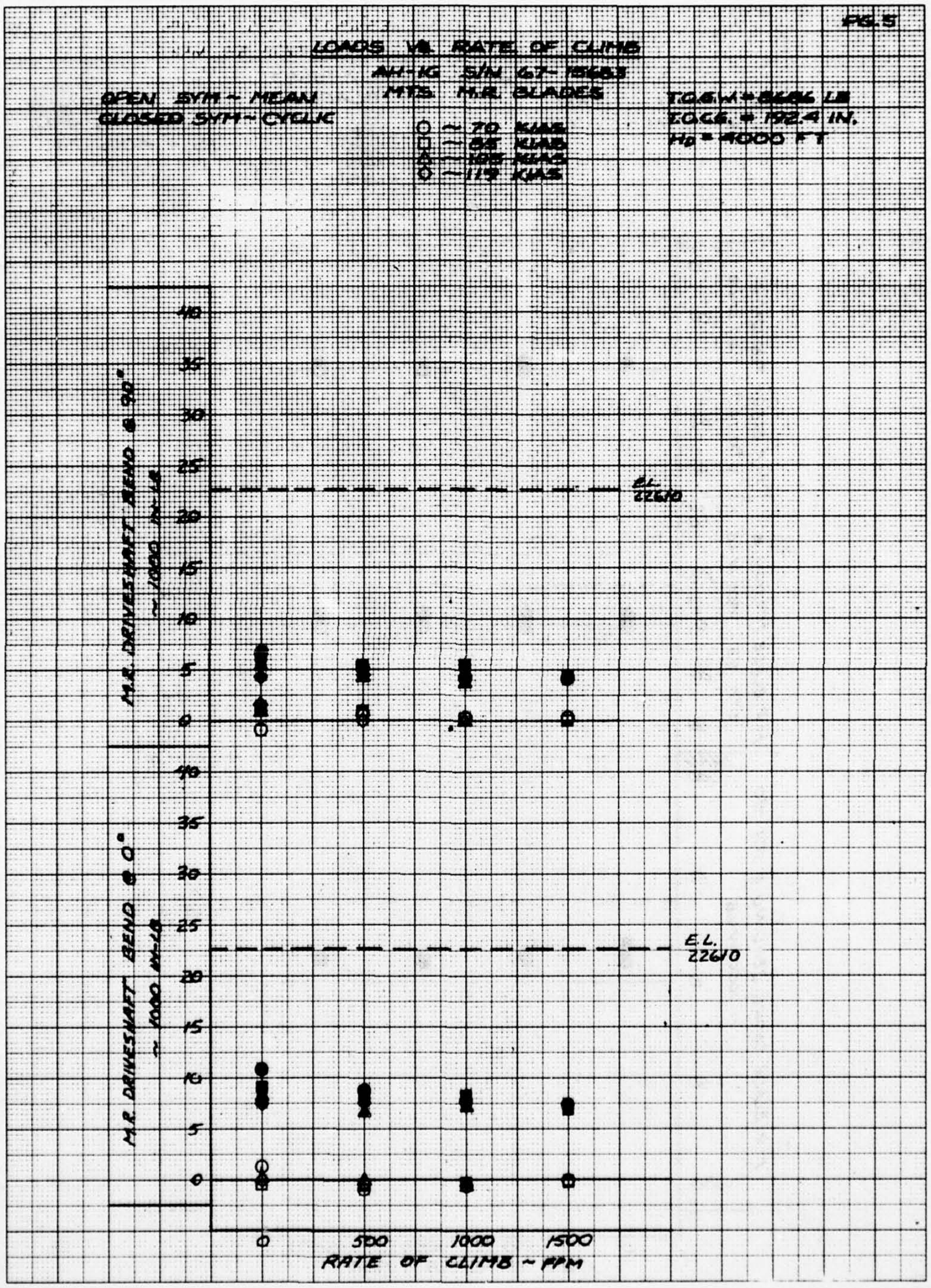


Figure E-5. Loads versus rate of climb (Sheet 5 of 8).

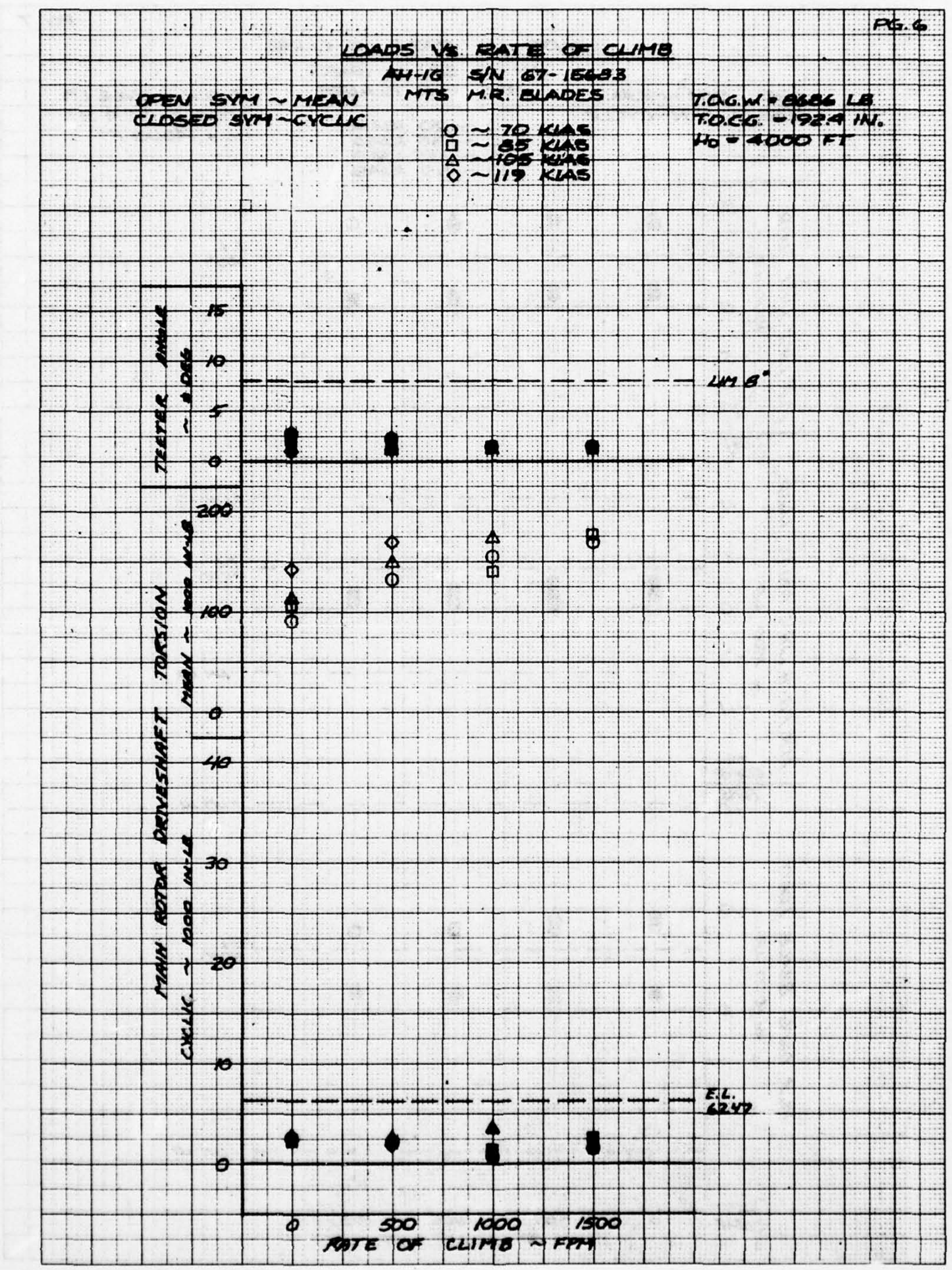


Figure E-5. Loads versus rate of climb (Sheet 6 of 8).

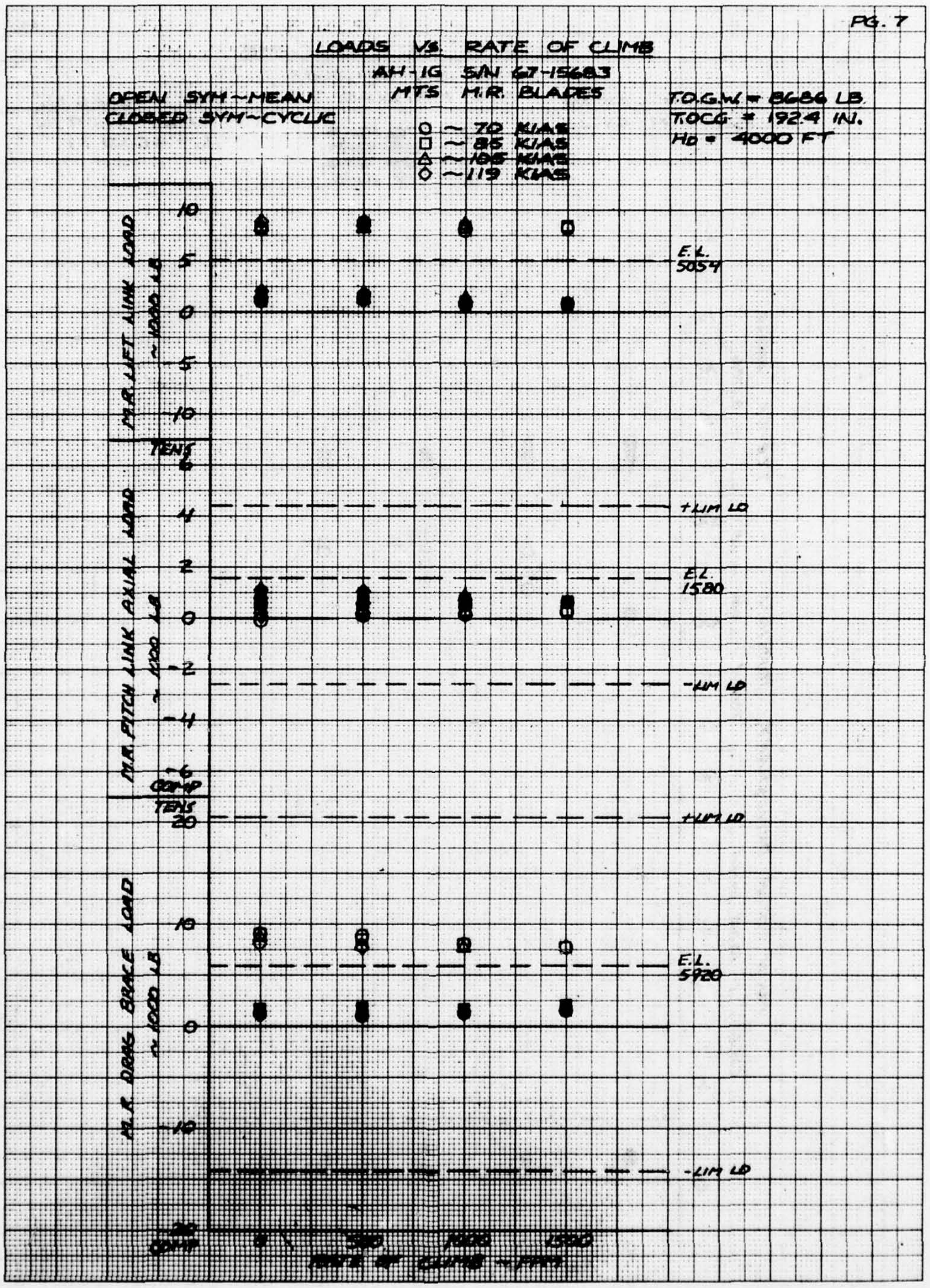


Figure E-5. Loads versus rate of climb (Sheet 7 of 8).

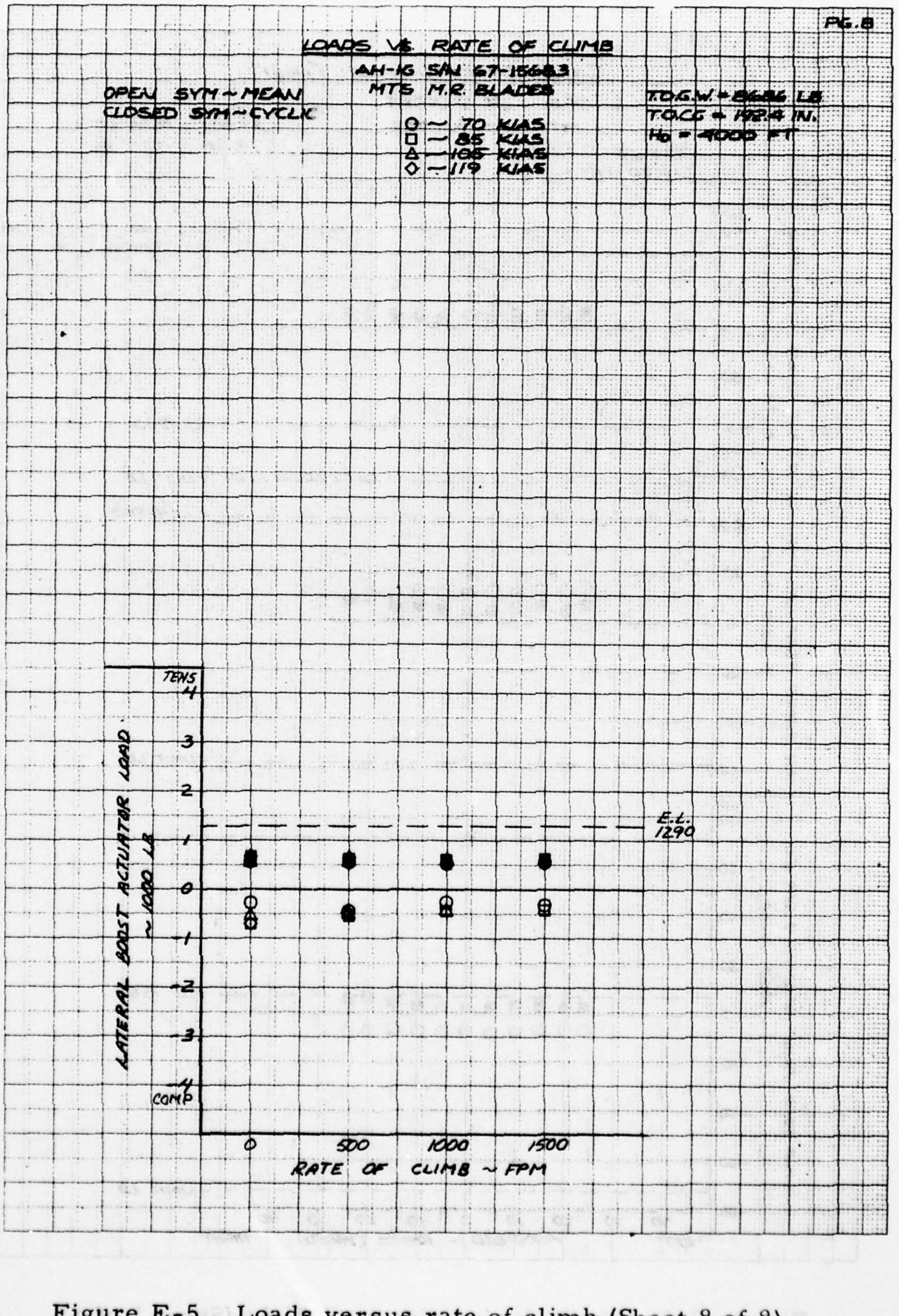


Figure E-5. Loads versus rate of climb (Sheet 8 of 8).

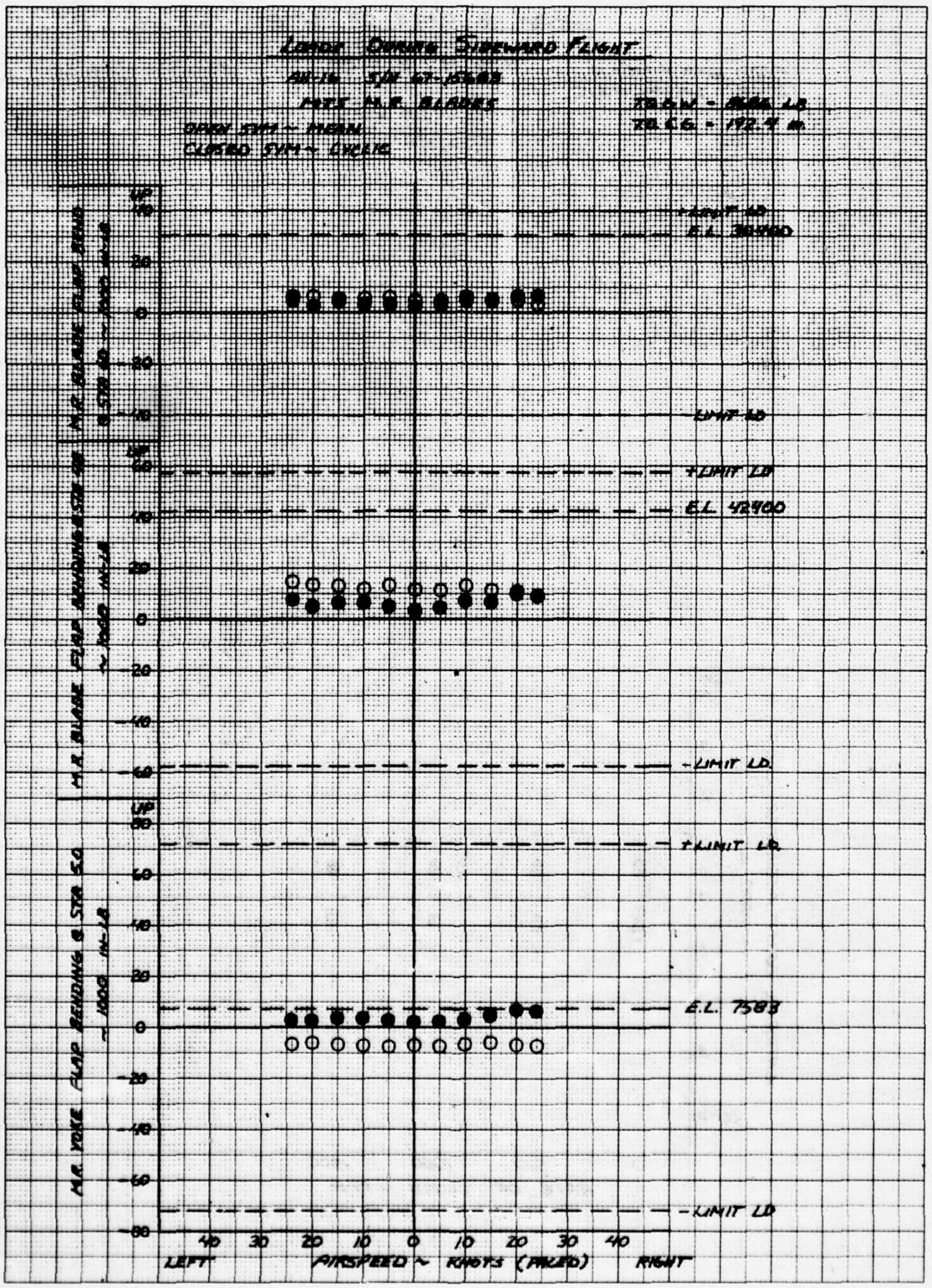


Figure E-6. Loads during sideward flight (Sheet 1 of 8).

AD-A046 176 HUGHES HELICOPTERS CULVER CITY CALIF F/G 1/3
FLIGHT TEST OF A COMPOSITE MULTI-TUBULAR SPAR MAIN ROTOR BLADE --ETC(U)
AUG 77 R E HEAD DAAJ02-74-C-0055
UNCLASSIFIED HH-76-281-VOL-1 USAAMRDL-TR-77-19A NL

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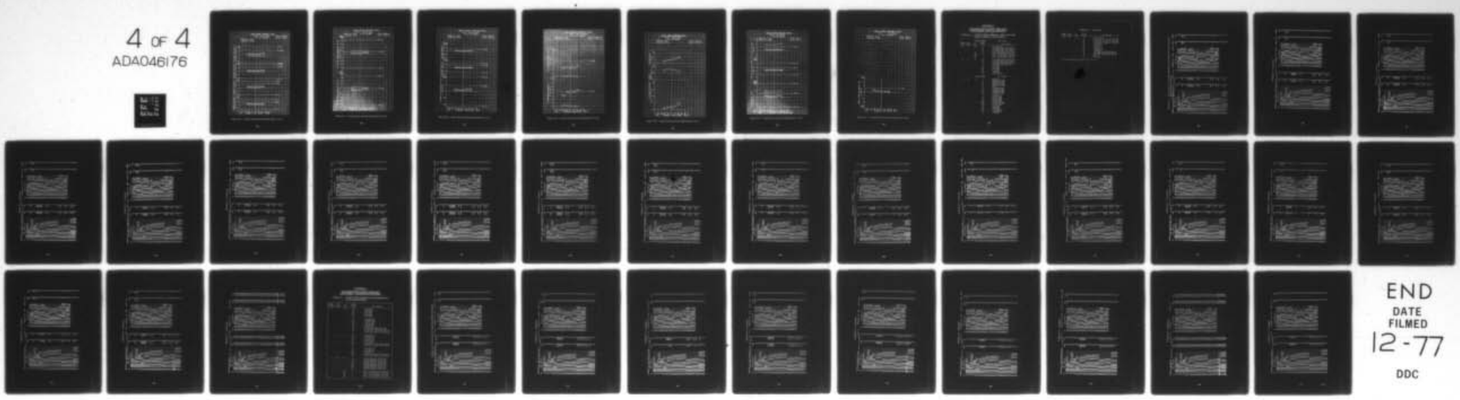

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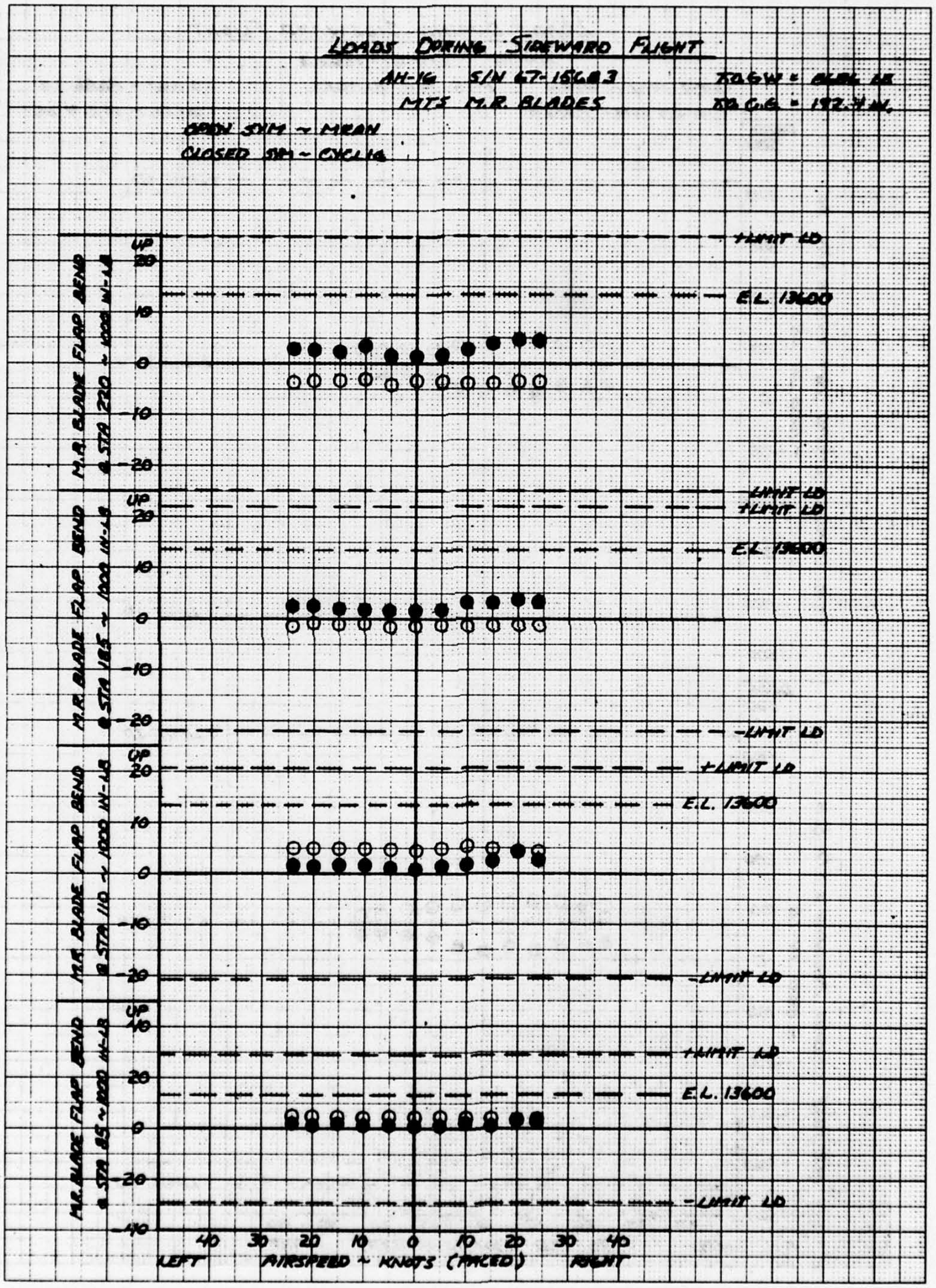

Figure E-6. Loads during sideward flight (Sheet 2 of 8).

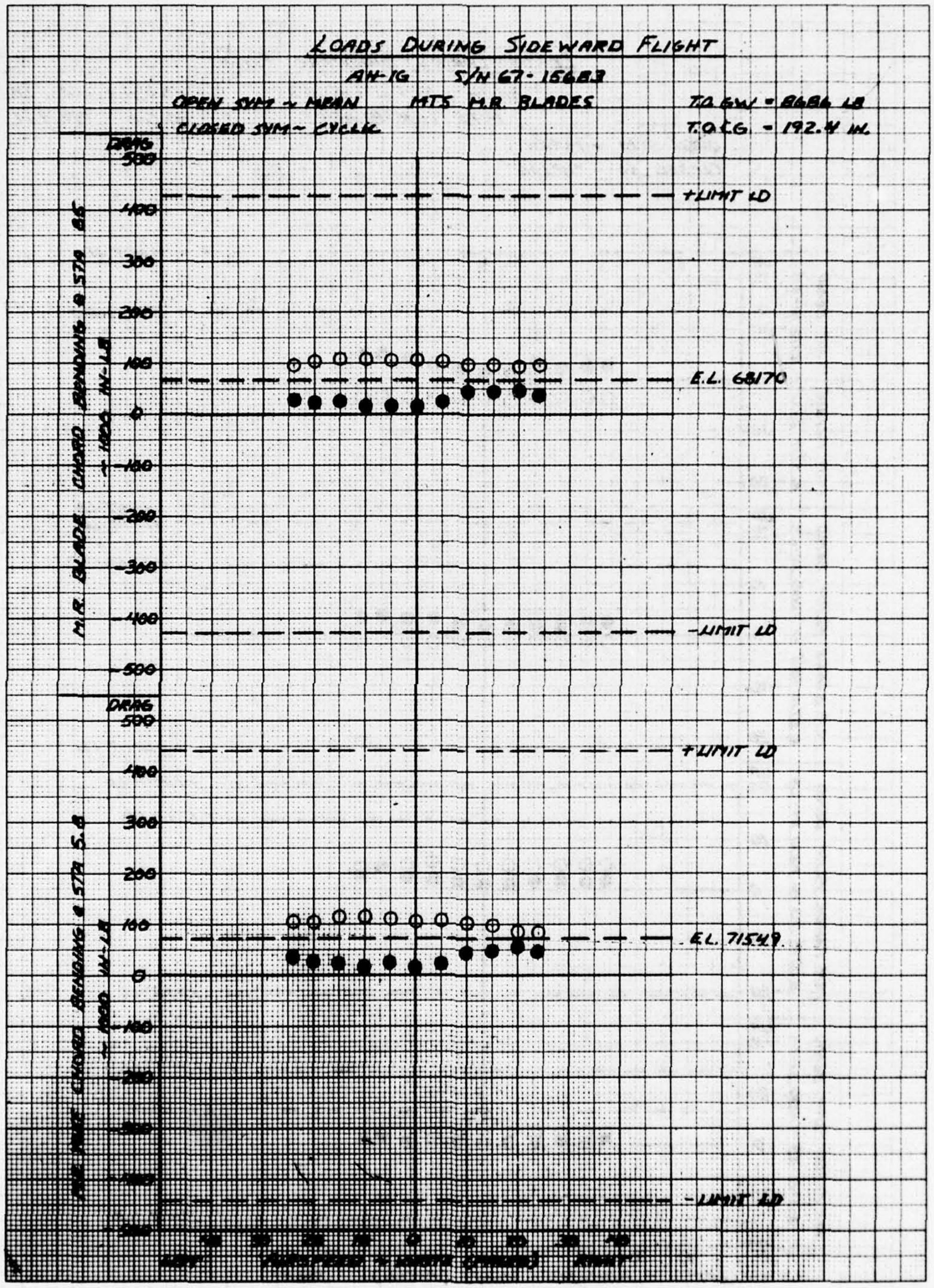

Figure E-6. Loads during sideward flight (Sheet 3 of 8).

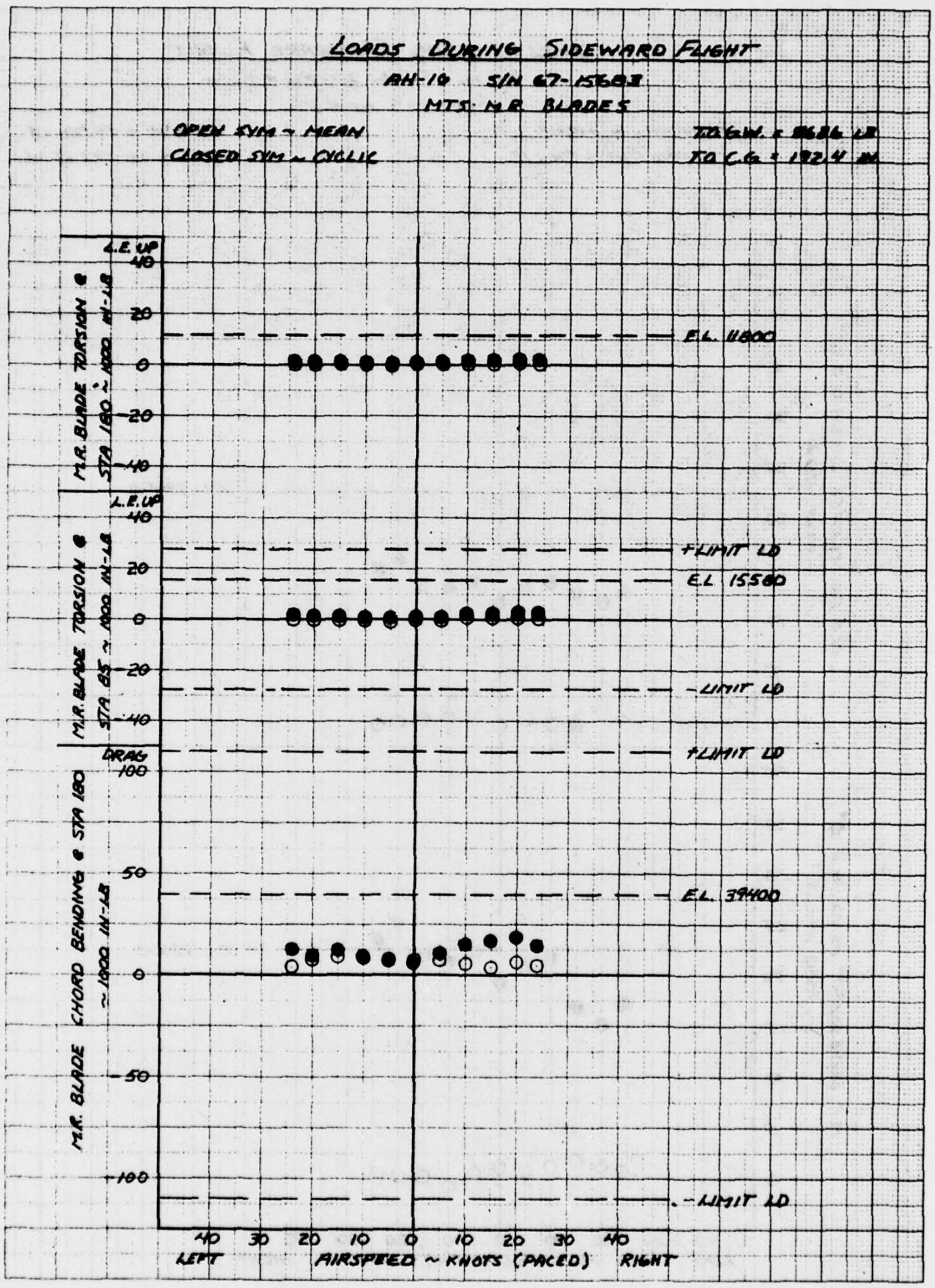

Figure E-6. Loads during sideward flight (Sheet 4 of 8).

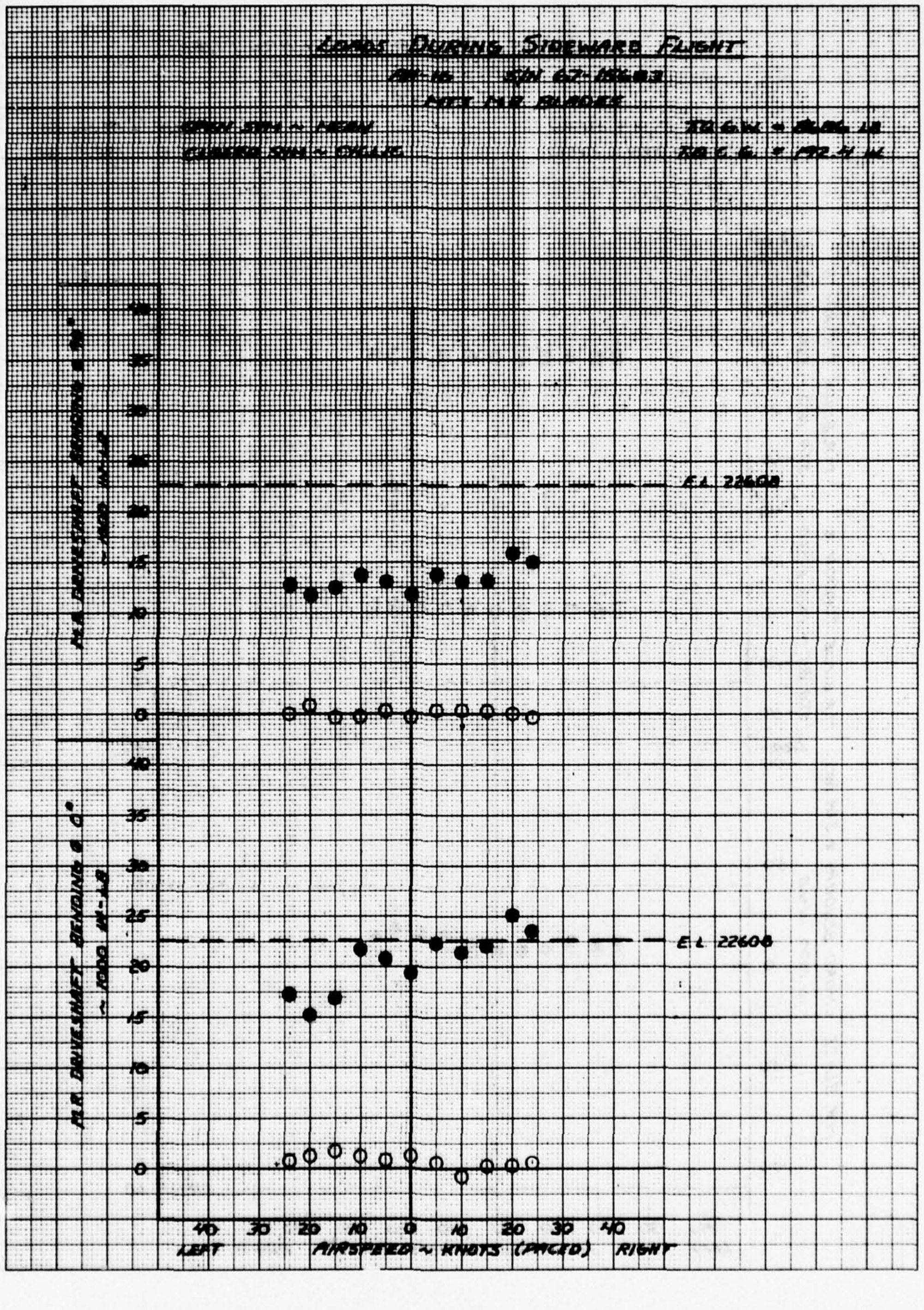

Figure E-6. Loads during sideward flight (Sheet 5 of 8).

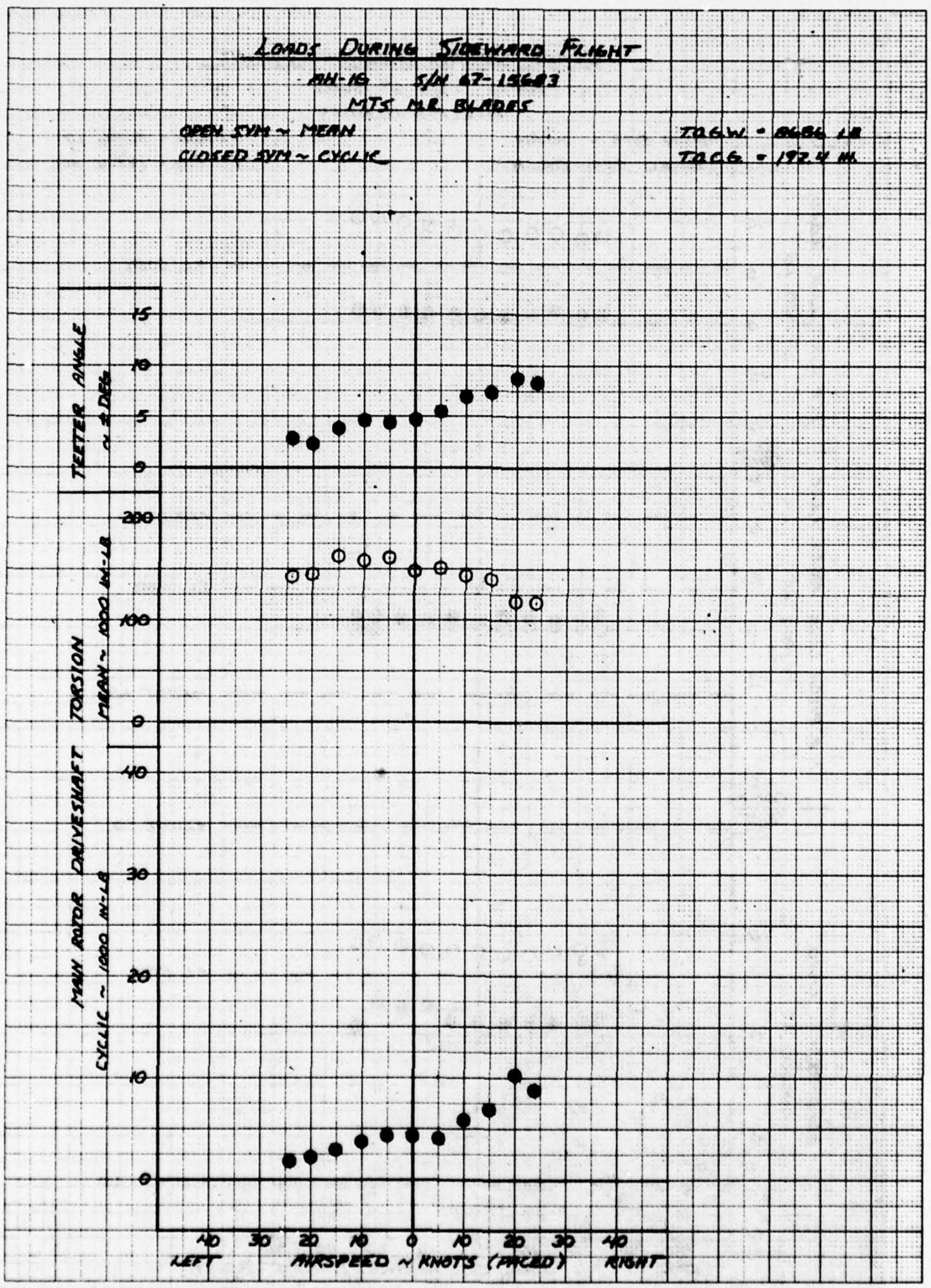

Figure E-6. Loads during sideward flight (Sheet 6 of 8).

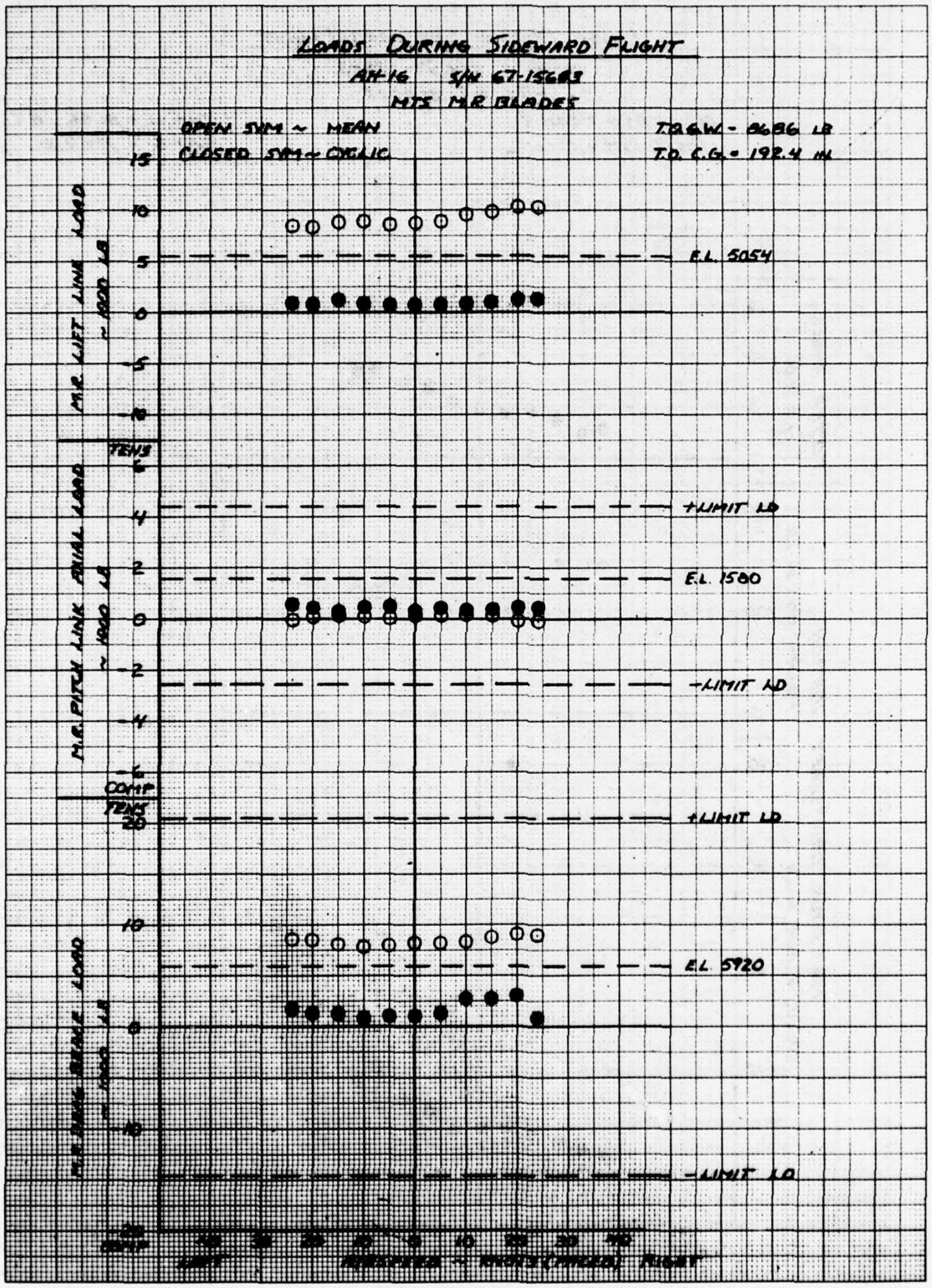

Figure E-6. Loads during sideward flight (Sheet 7 of 8).

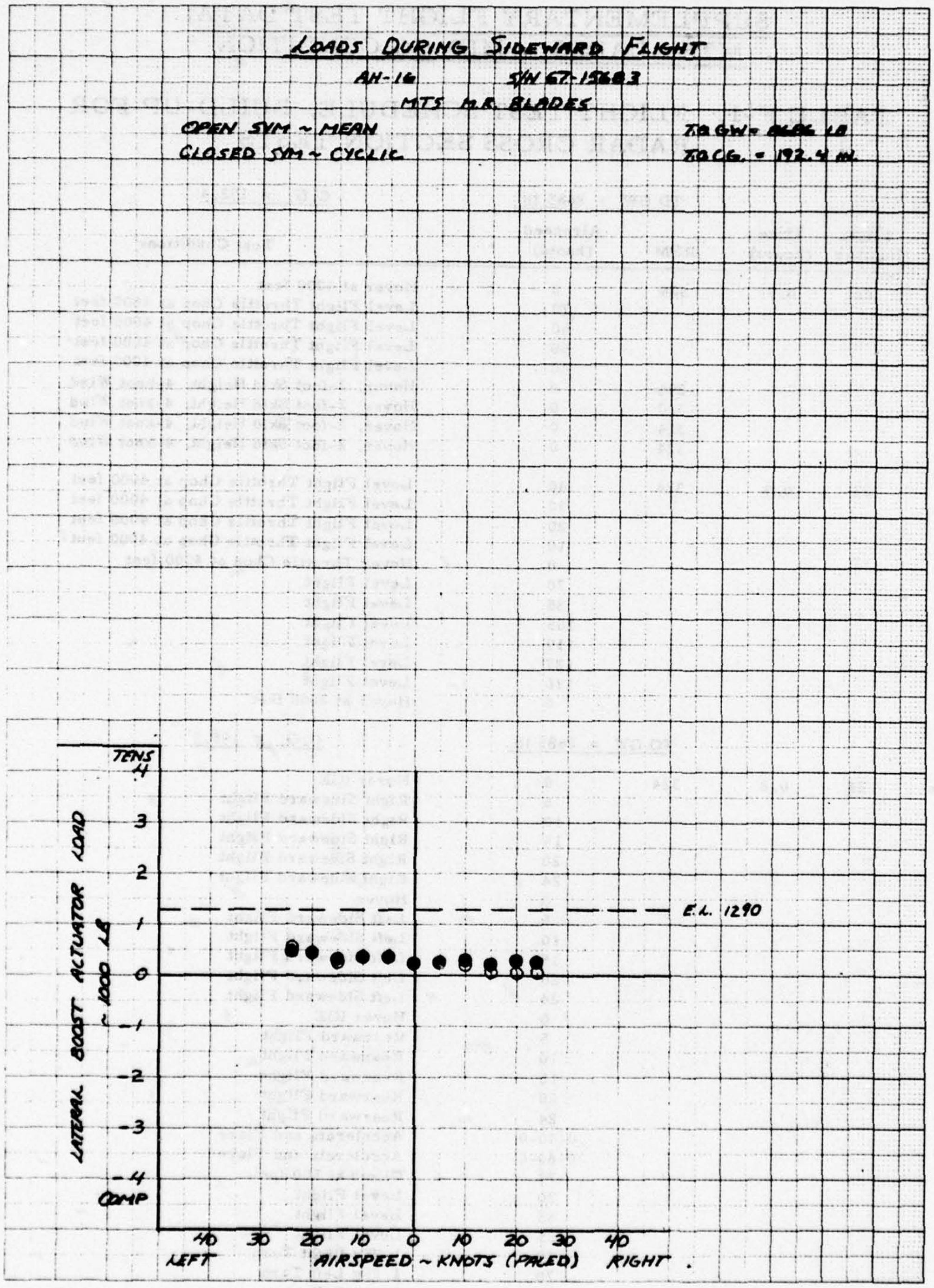

Figure E-6. Loads during sideward flight (Sheet 8 of 8).

APPENDIX F

SUPPLEMENTARY FLIGHT TEST DATA; MTS BLADES – MID-CG CONDITION

TABLE F-1. FLIGHT TEST SCHEDULE, BUILD-UP FOR RADAR CROSS SECTION TESTS

Flight Number	Time (hours)	RPM	Airspeed (knots)	Test Conditions
		TO GW = 8685 lb		C.G. = 192.4
22	0.7	324	0	Hover at 4000 feet
			70	Level Flight Throttle Chop at 4000 feet
			60	Level Flight Throttle Chop at 4000 feet
			50	Level Flight Throttle Chop at 4000 feet
			40	Level Flight Throttle Chop at 4000 feet
		294	0	Hover, 2-foot Skid Height, 4-knot Wind
		300	0	Hover, 2-foot Skid Height, 4-knot Wind
		314	0	Hover, 2-foot Skid Height, 4-knot Wind
		324	0	Hover, 2-foot Skid Height, 4-knot Wind
23	0.9	324	40	Level Flight Throttle Chop at 4000 feet
			30	Level Flight Throttle Chop at 4000 feet
			20	Level Flight Throttle Chop at 4000 feet
			10	Level Flight Throttle Chop at 4000 feet
			0	Hover Throttle Chop at 4000 feet
			70	Level Flight
			85	Level Flight
			105	Level Flight
			119	Level Flight
			127	Level Flight
			136	Level Flight
			0	Hover at 4000 feet
		TO GW = 8685 lb		C.G. = 195.9
24	0.8	324	0	Hover IGE
			5	Right Sideward Flight
			10	Right Sideward Flight
			15	Right Sideward Flight
			20	Right Sideward Flight
			24	Right Sideward Flight
			0	Hover
			5	Left Sideward Flight
			10	Left Sideward Flight
			15	Left Sideward Flight
			20	Left Sideward Flight
			24	Left Sideward Flight
			0	Hover IGE
			5	Rearward Flight
			10	Rearward Flight
			15	Rearward Flight
			20	Rearward Flight
			24	Rearward Flight
			0-40-0	Accelerate and Flare
			0-80-0	Accelerate and Flare
			70	Climb at 500 fpm
			70	Level Flight
			85	Level Flight
			105	Level Flight
			70	1.25g Right Turn
			70	1.25g Left Turn
			70	1.25g Pullup

TABLE F-1 - Continued

Flight Number	Time (hours)	RPM	Airspeed (knots)	Test Conditions
25	0.8	324	70	Climb at 1500 fpm
			70	Turn Reversal, 45° Left to 45° Right, Mild
			70	Turn Reversal, 45° Right to 45° Left, Mild
			105	Turn Reversal, 45° Left to 45° Right, Mild
			105	Turn Reversal, 45° Right to 45° Left, Mild
			70	1.5g Left Turn
			70	1.5g Right Turn
			70	1.5g Pullup
			105	1.25g Left Turn
			105	1.25g Right Turn
			105	1.25g Pullup
			70	Level Flight, Throttle Chop at 4000 feet
			50	Level Flight, Throttle Chop at 4000 feet
			30	Level Flight, Throttle Chop at 4000 feet
			0	Hover
			105	Level Flight

This completed the envelope expansion for the R.C.S. tests.

TABLE F-2. AH-1G S/N 67-15683 HUGHES HELICOPTERS MULTI-TUBULAR SPAR ROTOR BLADES

PARAMETER M.R. HUB FLAP BENDING @ STA.5.0 UNITS IN-LB ENDURANCE LIMIT 7583. STATIC LIMITS +-71987.
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS .	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	-7908.	3628.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	6889.	4813.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	1510.	8871.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	-6605.	6605.	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
12.	SIDEWARD FLIGHT - LEFT	-7256.	3163.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
13.	REARWARD FLIGHT	-8187.	5396.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	-8559.	3535.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	-8931.	2977.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	-6047.	6419.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	-9582.	2698.	70.	APPROACH AND FLARE TO HOVER ...	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	-7928.	1510.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS ...	0.	0.
33.	LEFT TURN, 70 KIAS	10381.	9343.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	2831.	8305.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS ....,.	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	10381.	5662.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	4152.	10003.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS .	6417.	4710.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	6606.	10192.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER M.R. BLADE FLAP BENDING @ STA.48 UNITS IN-LB ENDURANCE LIMIT 42400. STATIC LIMITS +-57500.
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	10294.	5059.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	13648.	16413.
6.	HOVER TURN, RIGHT 30 DEG/SEC	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	8811.	18486.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	7677.	9421.	61.	AUTOROTATION ENTRY - 70 KIAS	0.	0.
12.	SIDEWARD FLIGHT - LEFT	10119.	6281.	62.	STAB. AUTO, 324 RPM - 70 KIAS	0.	0.
13.	REARWARD FLIGHT	9247.	10643.	63.	STAB. AUTO, 324 RPM - 85 KIAS	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	6106.	10992.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	8549.	8898.	65.	STAB. AUTO, 294 RPM - 85 KIAS	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	5408.	13784.	66.	STAB. AUTO, 339 RPM - 85 KIAS	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	7502.	8898.	70.	APPROACH AND FLARE TO HOVER	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	10020.	6910.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS	0.	0.
33.	LEFT TURN, 70 KIAS	13130.	16585.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	11057.	16240.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	15549.	18659.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	10366.	19004.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS	15030.	19177.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	11057.	23151.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER M.R. BLADE FLAP BENDING @ STA.60 UNITS IN-LB ENDURANCE LIMIT 30400. STATIC LIMITS +-40000.
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS .	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	6599.	2999.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	8532.	11782.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	4875.	12594.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	4999.	6599.	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
12.	SIDEWARD FLIGHT - LEFT	6200.	4200.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
13.	REARWARD FLIGHT	4600.	7400.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	3400.	7400.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	5000.	6600.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	3400.	10598.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	4800.	6800.	70.	APPROACH AND FLARE TO HOVER ...	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	6907.	5282.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS ...	0.	0.
33.	LEFT TURN, 70 KIAS	7313.	10157.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	6907.	10563.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	9344.	13407.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	4875.	13001.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS .	8938.	13407.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	5282.	15438.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER M.R. BLADE FLAP BENDING @ STA.85 UNITS IN-LB ENDURANCE LIMIT 13600. STATIC LIMITS +-29220.
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	4936.	1809.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	4683.	4689.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	3702.	6828.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	3866.	3208.	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
12.	SIDEWARD FLIGHT - LEFT	3866.	2221.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
13.	REARWARD FLIGHT	3784.	3619.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	3784.	3784.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	3948.	3455.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	3290.	5430.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	4524.	3373.	70.	APPROACH AND FLARE TO HOVER ...	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	5265.	2632.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS ...	0.	0.
33.	LEFT TURN, 70 KIAS	4360.	4524.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	4278.	6087.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	4689.	4524.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	3619.	7075.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS .	4689.	4689.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	3290.	8062.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER M.R. BLADE FLAP BENDING @ STA.110 UNITS IN-LB ENDURANCE LIMIT 13600. STATIC LIMITS +-20800.
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	5460.	1716.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	4680.	4368.
6.	HOVER TURN, RIGHT 30 DEG/SEC	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	4290.	5850.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	4992.	2184.	61.	AUTOROTATION ENTRY - 70 KIAS	0.	0.
12.	SIDEWARD FLIGHT - LEFT	4836.	1872.	62.	STAB. AUTO, 324 RPM - 70 KIAS	0.	0.
13.	REARWARD FLIGHT	5070.	2730.	63.	STAB. AUTO, 324 RPM - 85 KIAS	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	4680.	3120.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	4680.	3276.	65.	STAB. AUTO, 294 RPM - 85 KIAS	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	4134.	4914.	66.	STAB. AUTO, 339 RPM - 85 KIAS	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	5460.	2964.	70.	APPROACH AND FLARE TO HOVER	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	6006.	2418.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS	0.	0.
33.	LEFT TURN, 70 KIAS	4446.	3354.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	4680.	5460.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	4758.	4134.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	4212.	6240.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS	4758.	3822.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	3744.	6240.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER M.R. BLADE FLAP BENDING @ STA.185 UNITS IN-LB ENDURANCE LIMIT 13600. STATIC LIMITS +-22070.
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS .	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	-1060.	2039.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	-3749.	4082.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	-3082.	5248.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	-2039.	3670.	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
12.	SIDEWARD FLIGHT - LEFT	-1631.	2773.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
13.	REARWARD FLIGHT	-1386.	4322.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	-2446.	2609.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	-2528.	2854.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	-2936.	3588.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	-1794.	2609.	70.	APPROACH AND FLARE TO HOVER ...	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	-1333.	2666.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS ...	0.	0.
33.	LEFT TURN, 70 KIAS	-3082.	6081.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	-3915.	5415.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	-3915.	4582.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	-3165.	5332.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS .	-3665.	3832.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	-3665.	7165.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER M.R. BLADE FLAP BENDING @ STA.220 UNITS IN-LB ENDURANCE LIMIT 13600. STATIC LIMITS +-24910.
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS .	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	-3357.	1799.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	-6234.	3477.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	-5815.	4736.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	-3477.	3837.	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
12.	SIDEWARD FLIGHT - LEFT	-2878.	3357.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
13.	REARWARD FLIGHT	-2638.	4796.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	-3537.	2818.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	-4256.	2098.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	-4316.	2998.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	-3957.	2038.	70.	APPROACH AND FLARE TO HOVER ...	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	-4436.	2158.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS ...	0.	0.
33.	LEFT TURN, 70 KIAS	-4556.	6714.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	-6054.	4256.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	-6894.	4496.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	-6714.	5635.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS .	-6054.	3537.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	-6714.	8512.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER M.R. HUB CHORD BENDING @ STA. 5.8 UNITS IN-LB ENDURANCE LIMIT 71549. STATIC LIMITS +-441000.
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	110074.	19174.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	62962.	37494.
6.	HOVER TURN, RIGHT 30 DEG/SEC	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	87723.	38202.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	94451.	51841.	61.	AUTOROTATION ENTRY - 70 KIAS	0.	0.
12.	SIDEWARD FLIGHT - LEFT	99422.	31247.	62.	STAB. AUTO, 324 RPM - 70 KIAS	0.	0.
13.	REARWARD FLIGHT	93740.	45450.	63.	STAB. AUTO, 324 RPM - 85 KIAS	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	63914.	18464.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	68175.	22725.	65.	STAB. AUTO, 294 RPM - 85 KIAS	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	80958.	26986.	66.	STAB. AUTO, 339 RPM - 85 KIAS	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	85219.	17044.	70.	APPROACH AND FLARE TO HOVER	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	108946.	25468.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS	0.	0.
33.	LEFT TURN, 70 KIAS	57303.	41739.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	86308.	42246.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	62255.	41031.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	86308.	42246.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS	67914.	39616.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	102579.	57303.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER M.R. BLADE CHORD BENDING @ STA.85 UNITS IN-LB ENDURANCE LIMIT 68170. STATIC LIMITS +-428000.
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS .	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	102520.	21710.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	89855.	53672.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	95886.	40405.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	92268.	40405.	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
12.	SIDEWARD FLIGHT - LEFT	97093.	25932.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
13.	REARWARD FLIGHT	94680.	46436.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	86238.	15077.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	91062.	23519.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	93474.	24725.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	104932.	18092.	70.	APPROACH AND FLARE TO HOVER ...	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	106138.	18091.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS ...	0.	0.
33.	LEFT TURN, 70 KIAS	87443.	34374.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	95886.	54878.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	85634.	59099.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	93474.	46435.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS .	89252.	56687.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	91062.	66939.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER M.R. BLADE CHORD BENDING @ STA.180 UNITS IN-LB ENDURANCE LIMIT 39400. STATIC LIMITS +-110000.
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	7112.	12132.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	5438.	24682.
6.	HOVER TURN, RIGHT 30 DEG/SEC	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	8785.	20499.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	7112.	18826.	61.	AUTOROTATION ENTRY - 70 KIAS	0.	0.
12.	SIDEWARD FLIGHT - LEFT	5020.	11714.	62.	STAB. AUTO, 324 RPM - 70 KIAS	0.	0.
13.	REARWARD FLIGHT	5439.	22173.	63.	STAB. AUTO, 324 RPM - 85 KIAS	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	7112.	6275.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	10459.	12132.	65.	STAB. AUTO, 294 RPM - 85 KIAS	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	11714.	12551.	66.	STAB. AUTO, 339 RPM - 85 KIAS	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	12551.	8367.	70.	APPROACH AND FLARE TO HOVER	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	10877.	6693.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS	0.	0.
33.	LEFT TURN, 70 KIAS	3765.	15479.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	6693.	25938.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	3765.	27193.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	12969.	28866.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS	4183.	28440.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	5438.	35560.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER M.R. BLADE TORSION BENDING @ STA.85 UNITS IN-LB ENDURANCE LIMIT 15580. STATIC LIMITS +-27720.
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS .	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	-331.	1159.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	-99.	4272.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	-298.	5663.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	166.	3312.	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
12.	SIDEWARD FLIGHT - LEFT	-248.	2236.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
13.	REARWARD FLIGHT	-248.	3064.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	-248.	2567.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	-248.	3561.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	-828.	4637.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	-331.	2815.	70.	APPROACH AND FLARE TO HOVER ...	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	-1192.	2980.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS	0.	0.
33.	LEFT TURN, 70 KIAS	298.	2682.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	-397.	5564.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	298.	4670.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	-99.	5862.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS .	794.	4968.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	-596.	7353.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER M.R. BLADE TORSION BENDING @ STA.180 UNITS IN-LB ENDURANCE LIMIT 11800. STATIC LIMITS
TOGW= 8685 LB TDCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS .	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	72.	790.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	574.	4020.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	-430.	4595.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	215.	2226.	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
12.	SIDEWARD FLIGHT - LEFT	215.	1651.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
13.	REARWARD FLIGHT	287.	2154.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	574.	2298.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	359.	2800.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	0.	3446.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	503.	2226.	70.	APPROACH AND FLARE TO HOVER ...	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	-72.	2225.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS	0.	0.
33.	LEFT TURN, 70 KIAS	0.	2441.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	718.	4451.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	646.	4380.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	-502.	4523.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS .	1077.	4092.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	-359.	5815.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER PITCH LINK LOAD UNITS LB ENDURANCE LIMIT 1580. STATIC LIMITS +4400.,-2550.
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	101.	449.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	14.	1086.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	188.	1114.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	116.	521.	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
12.	SIDEWARD FLIGHT - LEFT	-29.	550.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
13.	REARWARD FLIGHT	-72.	796.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	72.	710.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	159.	796.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	130.	999.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	232.	695.	70.	APPROACH AND FLARE TO HOVER ...	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	362.	680.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS ...	0.	0.
33.	LEFT TURN, 70 KIAS	29.	752.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	202.	1071.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	-58.	1158.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	130.	1201.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS .	29.	1129.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	14.	1491.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER M.R. BLADE DRAG BRACE LOAD UNITS LB ENDURANCE LIMIT 5920. STATIC LIMITS +20518.,-14189.
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS .	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	7899.	1070.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	9711.	2948.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	8866.	2194.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	8605.	2641.	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
12.	SIDEWARD FLIGHT - LEFT	8264.	1571.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
13.	REARWARD FLIGHT	8514.	3005.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	8969.	956.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	8719.	1343.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	8605.	1320.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	8423.	1093.	70.	APPROACH AND FLARE TO HOVER ...	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	7998.	1188.	72.	LEFT SIDESLIP - 85 KIAS ......,	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS ...	0.	0.
33.	LEFT TURN, 70 KIAS	10168.	2354.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	8912.	2651.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	9894.	3085.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	8980.	2399.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS .	9483.	3039.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	9300.	3587.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER M.R. MAST BENDING @ 0. DEG. UNITS IN-LB ENDURANCE LIMIT 22610. STATIC LIMITS
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	-309.	11426.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	0.	7260.
6.	HOVER TURN, RIGHT 30 DEG/SEC	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	-303.	7562.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	-926.	14514.	61.	AUTOROTATION ENTRY - 70 KIAS	0.	0.
12.	SIDEWARD FLIGHT - LEFT	-309.	15749.	62.	STAB. AUTO, 324 RPM - 70 KIAS	0.	0.
13.	REARWARD FLIGHT	-618.	19146.	63.	STAB. AUTO, 324 RPM - 85 KIAS	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	-309.	4014.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	-309.	6485.	65.	STAB. AUTO, 294 RPM - 85 KIAS	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	309.	5250.	66.	STAB. AUTO, 339 RPM - 85 KIAS	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	309.	5250.	70.	APPROACH AND FLARE TO HOVER	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	-303.	6957.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS	0.	0.
33.	LEFT TURN, 70 KIAS	303.	10587.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	303.	9982.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	0.	8470.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	-605.	7260.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS	-303.	6352.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	-605.	8470.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER M.R. MAST BENDING @ 90 DEG. UNITS IN-LB ENDURANCE LIMIT 22610. STATIC LIMITS
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS .	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	958.	7344.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	-319.	4789.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	319.	2234.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	639.	7663.	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
12.	SIDEWARD FLIGHT - LEFT	319.	11175.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
13.	REARWARD FLIGHT	958.	12452.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	0.	1916.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	639.	2554.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	958.	1596.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	319.	2235.	70.	APPROACH AND FLARE TO HOVER ...	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	0.	3331.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS	0.	0.
33.	LEFT TURN, 70 KIAS	-319.	7982.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	0.	3831.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	0.	5747.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	638.	1915.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS	-319.	3512.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	-638.	5108.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER THRUST LINK LOAD UNITS LB ENDURANCE LIMIT 5054. STATIC LIMITS
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL - 119 KIAS .	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	7401.	639.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	9503.	1644.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	9320.	2193.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	8132.	1188.	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
12.	SIDEWARD FLIGHT - LEFT	7767.	1188.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
13.	REARWARD FLIGHT	8681.	1553.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	7127.	1279.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	7036.	1188.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	7950.	1919.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	6945.	1097.	70.	APPROACH AND FLARE TO HOVER ...	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	7035.	822.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS ...	0.	0.
33.	LEFT TURN, 70 KIAS	9868.	1644.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	8772.	2193.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	10325.	1553.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	9411.	2101.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS .	9228.	1918.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	9320.	2375.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER LATERAL ACTUATOR LOAD   UNITS LB   ENDURANCE LIMIT 1290.   STATIC LIMITS
TOGW= 8685 LB   TOCG= 195.9 IN   HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS .	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	295.	389.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	-808.	963.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	-793.	979.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	15.	451.	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
12.	SIDEWARD FLIGHT - LEFT	451.	482.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
13.	REARWARD FLIGHT	389.	606.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	-544.	606.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	-653.	683.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	-637.	637.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	-575.	575.	70.	APPROACH AND FLARE TO HOVER ...	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	-513.	575.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS ...	0.	0.
33.	LEFT TURN, 70 KIAS	-528.	715.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	-793.	1010.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	808.	1119.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	-793.	1134.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS .	-855.	1072.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	-870.	1492.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - [illegible]	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER M.R. DRIVESHAFT TORSION UNITS IN-LB ENDURANCE LIMIT 38980. STATIC LIMITS
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS .	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	151228.	2551.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	68872.	2221.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	110343.	2962.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	132279.	4737.	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
12.	SIDEWARD FLIGHT - LEFT	134465.	4008.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
13.	REARWARD FLIGHT	130821.	5466.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	91830.	2186.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	100576.	2186.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	115152.	2186.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	0.	0.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	0.	0.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	122076.	1093.	70.	APPROACH AND FLARE TO HOVER ...	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	155147.	1851.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS	0.	0.
33.	LEFT TURN, 70 KIAS	64058.	1851.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	0.	0.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	106270.	3332.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	0.	0.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	64799.	2591.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	0.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	108492.	2592.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	0.	0.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
[illegible]	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS .	80350.	3332.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	0.	0.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	115527.	3702.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE F-2 - Continued

PARAMETER TEETER ANGLE UNITS DEG. ENDURANCE LIMIT STATIC LIMITS
TOGW= 8685 LB TOCG= 195.9 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.00	0.00	51.	TURN REVERSAL, MOD. - 136 KIAS	0.00	0.00
2.	NORMAL SHUTDOWN 100-0%	0.00	0.00	52.	F/A CONT. REVERSAL - 119 KIAS	0.00	0.00
3.	NORMAL TAKEOFF	0.00	0.00	53.	LAT. CONT. REVERSAL- 119 KIAS .	0.00	0.00
4.	JUMP TAKEOFF	0.00	0.00	54.	DIR. CONT. REVERSAL - 119 KIAS	0.00	0.00
5.	HOVER IGE 324 RPM	0.00	1.93	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	0.00	1.33
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.00	0.00	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.00	0.00
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.00	0.00	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	0.00	0.40
8.	HOVER, F/A REVERSAL	0.00	0.00	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.00	0.00
9.	HOVER, LAT. REVERSAL	0.00	0.00	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.00	0.00
10.	HOVER, DIR. REVERSAL	0.00	0.00	60.	PULLUP, DIVE - 136 KIAS	0.00	0.00
11.	SIDEWARD FLIGHT - RIGHT	0.00	4.94	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.00	0.00
12.	SIDEWARD FLIGHT - LEFT	0.00	2.69	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.00	0.00
13.	REARWARD FLIGHT	0.00	5.27	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.00	0.00
14.	LEVEL FLIGHT - 70 KIAS	0.00	0.40	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.00	0.00
15.	LEVEL FLIGHT - 85 KIAS	0.00	0.52	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.00	0.00
16.	LEVEL FLIGHT - 102 KIAS	0.00	0.52	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.00	0.00
17.	LEVEL FLIGHT - 119 KIAS	0.00	0.00	67.	AUTO TURN, RIGHT - 70 KIAS	0.00	0.00
18.	LEVEL FLIGHT - 127 KIAS	0.00	0.00	68.	AUTO TURN, LEFT - 70 KIAS	0.00	0.00
19.	LEVEL FLIGHT - 136 KIAS	0.00	0.00	69.	AUTO PWR. RECOVERY	0.00	0.00
20.	CLIMB, 500 FPM - 70 KIAS	0.00	0.60	70.	APPROACH AND FLARE TO HOVER ...	0.00	0.00
21.	CLIMB, 1000 FPM - 70 KIAS	0.00	0.00	71.	LEFT SIDESLIP - 70 KIAS	0.00	0.00
22.	CLIMB, 1500 FPM - 70 KIAS	0.00	0.96	72.	LEFT SIDESLIP - 85 KIAS	0.00	0.00
23.	CLIMB, 500 FPM - 85 KIAS	0.00	0.00	73.	LEFT SIDESLIP - 136 KIAS	0.00	0.00
24.	CLIMB, 1000 FPM - 85 KIAS	0.00	0.00	74.	RIGHT SIDESLIP - 70 KIAS	0.00	0.00
25.	CLIMB, 1500 FPM - 85 KIAS	0.00	0.00	75.	RIGHT SIDESLIP - 85 KIAS	0.00	0.00
26.	CLIMB, 500 FPM - 105 KIAS	0.00	0.00	76.	RIGHT SIDESLIP - 136 KIAS	0.00	0.00
27.	CLIMB, 1000 FPM - 105 KIAS	0.00	0.00	77.	DIVE, STEADY - 119 KIAS	0.00	0.00
28.	CLIMB, 500 FPM - 119 KIAS	0.00	0.00	78.	DIVE, STEADY - 136 KIAS	0.00	0.00
29.	CLIMB, MAX.RATE - 70 KIAS	0.00	0.00	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.00	0.00
30.	CLIMB, MAX.RATE - 105 KIAS	0.00	0.00	80.	DIVE, LEFT TURN - 119 KIAS	0.00	0.00
31.	CLIMB, MAX.RATE - 119 KIAS	0.00	0.00	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.00	0.00
32.	CLIMB, MAX.RATE - 136 KIAS	0.00	0.00	82.	DIVE, LEFT TURN - 136 KIAS	0.00	0.00
33.	LEFT TURN, 70 KIAS	0.00	2.13	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.00	0.00
34.	LEFT TURN, 85 KIAS	0.00	0.00	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.00	0.00
35.	LEFT TURN, 105 KIAS	0.00	0.88	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.00	0.00
36.	LEFT TURN, 119 KIAS	0.00	0.00	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.00	0.00
37.	LEFT TURN, 127 KIAS	0.00	0.00	87.	DIVE, PULLUP - 119 KIAS	0.00	0.00
38.	LEFT TURN, 136 KIAS	0.00	0.00	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.00	0.00
39.	RIGHT TURN, 70 KIAS	0.00	2.17	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.00	0.00
40.	RIGHT TURN, 85 KIAS	0.00	0.00	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.00	0.00
41.	RIGHT TURN, 105 KIAS	0.00	0.48	91.	QUICK STOP - 136 KIAS TO HOVER.	0.00	0.00
42.	RIGHT TURN, 119 KIAS	0.00	0.00			0.00	0.00
43.	RIGHT TURN, 127 KIAS	0.00	0.00			0.00	0.00
44.	RIGHT TURN, 136 KIAS	0.00	0.00			0.00	0.00
45.	TURN REVERSAL, MILD - 70 KIAS .	0.00	1.68			0.00	0.00
46.	TURN REVERSAL, MILD - 85 KIAS .	0.00	0.00			0.00	0.00
47.	TURN REVERSAL, MILD - 105 KIAS	0.00	1.44			0.00	0.00
48.	TURN REVERSAL, MILD - 119 KIAS	0.00	0.00			0.00	0.00
49.	TURN REVERSAL, MILD - 136 KIAS	0.00	0.00			0.00	0.00
50.	TURN REVERSAL, MOD. - 105 KIAS	0.00	0.00			0.00	0.00

APPENDIX G

SUPPLEMENTARY FLIGHT TEST DATA; 540 BLADES – FORWARD CG CONDITION

TABLE G-1. FLIGHT TEST SCHEDULE SUPPLEMENTARY 540 BLADE PROGRAM

Flight Number	Time (hours)	RPM	Airspeed (knots)	Test Condition
30	1.3	324	68	Level Flight
			85	Level Flight
			105	Level Flight
			119	Level Flight
			127	Level Flight
			136	Level Flight
			85	1.25g Right Turn
			85	1.60g Right Turn
			85	1.90g Right Turn
			85	1.25g Left Turn
			85	1.60g Left Turn
			85	1.90g Left Turn
			85	Turn Reversal, Left to Right, Mild
			85	Turn Reversal, Right to Left, Mild
			85	Turn Reversal, Left to Right, Moderate
			85	Turn Reversal, Right to Left, Moderate
			119	1.25g Right Turn
			119	1.50g Right Turn
			119	1.80g Right Turn
			119	1.25g Left Turn
			119	1.50g Left Turn
			119	1.80g Left Turn
			119	Turn Reversal, Left to Right, Moderate
			119	Turn Reversal, Right to Left, Moderate
			136	1.25g Right Turn
			136	1.50g Right Turn
			136	1.25g Left Turn
			136	1.50g Left Turn
			136	Turn Reversal, Left to Right, Moderate
			136	Turn Reversal, Right to Left, Moderate
31	0.8	324	70	Airspeed Calibration, West to East
			70	Airspeed Calibration, East to West
			86	Airspeed Calibration, West to East
			85	Airspeed Calibration, East to West
			119	Airspeed Calibration, West to East
			120	Airspeed Calibration, East to West
			136	Airspeed Calibration, West to East
			136	Airspeed Calibration, East to West
		324	0	Hover, 2-foot Skid Height, 4-knot Wind
		314	0	Hover, 2-foot Skid Height, 4-knot Wind
		304	0	Hover, 2-foot Skid Height, 4-knot Wind
		294	0	Hover, 2-foot Skid Height, 4-knot Wind
		324	0	Hover, 2-foot Skid Height, 4-knot Wind

TABLE G-2. AH-1G S/N 67-15683 540 METAL BLADES

PARAMETER M.R. HUB FLAP BENDING @ STA.5.0 UNITS IN-LB ENDURANCE LIMIT 7583. STATIC LIMITS +-71987.
TOGW= 8685 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	3680.	11608.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	0.	0.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	0.	0.
6.	HOVER TURN, RIGHT 30 DEG/SEC	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	0.	0.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	0.	0.	61.	AUTOROTATION ENTRY - 70 KIAS	0.	0.
12.	SIDEWARD FLIGHT - LEFT	0.	0.	62.	STAB. AUTO, 324 RPM - 70 KIAS	0.	0.
13.	REARWARD FLIGHT	0.	0.	63.	STAB. AUTO, 324 RPM - 85 KIAS	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	-7361.	3775.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	-8022.	3492.	65.	STAB. AUTO, 294 RPM - 85 KIAS	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	-6984.	4719.	66.	STAB. AUTO, 339 RPM - 85 KIAS	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	-8022.	5191.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	-7361.	6040.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	-8305.	6418.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	0.	0.	70.	APPROACH AND FLARE TO HOVER	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	0.	0.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS	0.	0.
33.	LEFT TURN, 70 KIAS	0.	0.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	13496.	8022.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	0.	0.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	6040.	7928.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	5757.	9532.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	0.	0.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	16988.	7173.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	0.	0.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	10664.	9721.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	4436.	9721.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS	0.	0.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS	3869.	5568.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	0.	0.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE G-2 - Continued

PARAMETER M.R. MAST BENDING @ 0. DEG. UNITS IN-LB ENDURANCE LIMIT 22610. STATIC LIMITS
TOGW= 8685 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	-605.	10285.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	0.	0.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	0.	0.
6.	HOVER TURN, RIGHT 30 DEG/SEC	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	0.	0.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	0.	0.	61.	AUTOROTATION ENTRY - 70 KIAS	0.	0.
12.	SIDEWARD FLIGHT - LEFT	0.	0.	62.	STAB. AUTO, 324 RPM - 70 KIAS	0.	0.
13.	REARWARD FLIGHT	0.	0.	63.	STAB. AUTO, 324 RPM - 85 KIAS	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	-1210.	9680.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	-1210.	7865.	65.	STAB. AUTO, 294 RPM - 85 KIAS	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	-605.	6050.	66.	STAB. AUTO, 339 RPM - 85 KIAS	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	-605.	4840.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	-908.	5143.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	-303.	6353.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	0.	0.	70.	APPROACH AND FLARE TO HOVER	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	0.	0.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS	0.	0.
33.	LEFT TURN, 70 KIAS	0.	0.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	-2420.	21175.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	0.	0.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	-908.	11798.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	-605.	9680.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	0.	0.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	-1815.	22385.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	0.	0.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	-2420.	13310.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	-1513.	7563.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS	0.	0.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS	-303.	12403.			0.	0.
47.	TURN REVERSAL, MILD 105 KIAS	0.	0.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE G-2 - Continued

PARAMETER M.R. MAST BENDING @ 90 DEG. UNITS IN-LB ENDURANCE LIMIT 22610. STATIC LIMITS
TOGW= 8685 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	0.	0.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	0.	0.
6.	HOVER TURN, RIGHT 30 DEG/SEC	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	0.	0.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	0.	0.	61.	AUTOROTATION ENTRY - 70 KIAS	0.	0.
12.	SIDEWARD FLIGHT - LEFT	0.	0.	62.	STAB. AUTO, 324 RPM - 70 KIAS	0.	0.
13.	REARWARD FLIGHT	0.	0.	63.	STAB. AUTO, 324 RPM - 85 KIAS	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	0.	5625.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	0.	5000.	65.	STAB. AUTO, 294 RPM - 85 KIAS	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	625.	4375.	66.	STAB. AUTO, 339 RPM - 85 KIAS	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	-625.	3750.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	-312.	3437.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	0.	0.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	0.	0.	70.	APPROACH AND FLARE TO HOVER	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	0.	0.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS	0.	0.
33.	LEFT TURN, 70 KIAS	0.	0.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	-937.	15937.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	0.	0.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	312.	9062.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	0.	0.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	0.	0.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	0.	16874.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	0.	0.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	-312.	10937.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	0.	0.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS	0.	0.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS	312.	8437.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	0.	0.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE G-2 - Continued

PARAMETER M.R. HUB CHORD BENDING @ STA. 5.8 UNITS IN-LB ENDURANCE LIMIT 71549. STATIC LIMITS +-441000.
TOGW= 8685 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	134241.	103452.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	0.	0.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	0.	0.
6.	HOVER TURN, RIGHT 30 DEG/SEC	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	0.	0.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	0.	0.	61.	AUTOROTATION ENTRY - 70 KIAS	0.	0.
12.	SIDEWARD FLIGHT - LEFT	0.	0.	62.	STAB. AUTO, 324 RPM - 70 KIAS	0.	0.
13.	REARWARD FLIGHT	0.	0.	63.	STAB. AUTO, 324 RPM - 85 KIAS	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	67736.	20937.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	75741.	28942.	65.	STAB. AUTO, 294 RPM - 85 KIAS	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	84363.	31405.	66.	STAB. AUTO, 339 RPM - 85 KIAS	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	98526.	36947.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	106530.	44952.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	122541.	52342.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	0.	0.	70.	APPROACH AND FLARE TO HOVER	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	0.	0.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS	0.	0.
33.	LEFT TURN, 70 KIAS	0.	0.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	36947.	33252.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	0.	0.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	89289.	49879.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	120694.	71431.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	0.	0.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	35100.	38794.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	0.	0.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	88673.	68968.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	123157.	72663.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS	0.	0.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS	72047.	52342.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	0.	0.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE G-2 - Continued

PARAMETER THRUST LINK LOAD UNITS LB ENDURANCE LIMIT 5054. STATIC LIMITS
TOGW= 8685 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	9777.	3381.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS .	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	0.	0.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	0.	0.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	0.	0.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	0.	0.	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
12.	SIDEWARD FLIGHT - LEFT	0.	0.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
13.	REARWARD FLIGHT	0.	0.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	7950.	1188.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	7858.	914.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	8132.	1371.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	8041.	1645.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	8315.	1919.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	8498.	2234.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	0.	0.	70.	APPROACH AND FLARE TO HOVER ...	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	0.	0.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS	0.	0.
33.	LEFT TURN, 70 KIAS	0.	0.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	12336.	1553.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	0.	0.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	10325.	2467.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	10508.	3198.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	0.	0.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	13249.	1736.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	0.	0.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	11422.	2467.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	10600.	3107.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS .	0.	0.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	10051.	1645.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	0.	0.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE G-2 - Continued

PARAMETER PITCH LINK LOAD UNITS LB ENDURANCE LIMIT 1580. STATIC LIMITS +4400.,-2550.
TOGW= 8685 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.
2.	NORMAL SHUTDOWN 100-0%	0.	0.
3.	NORMAL TAKEOFF	0.	0.
4.	JUMP TAKEOFF	0.	0.
5.	HOVER IGE 324 RPM	0.	0.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.
8.	HOVER, F/A REVERSAL	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	0.	0.
12.	SIDEWARD FLIGHT - LEFT	0.	0.
13.	REARWARD FLIGHT	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	159.	594.
15.	LEVEL FLIGHT - 85 KIAS	174.	869.
16.	LEVEL FLIGHT - 102 KIAS	550.	782.
17.	LEVEL FLIGHT - 119 KIAS	550.	898.
18.	LEVEL FLIGHT - 127 KIAS	478.	999.
19.	LEVEL FLIGHT - 136 KIAS	623.	999.
20.	CLIMB, 500 FPM - 70 KIAS	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.
33.	LEFT TURN, 70 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	275.	912.
35.	LEFT TURN, 105 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	507.	1115.
37.	LEFT TURN, 127 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	434.	1129.
39.	RIGHT TURN, 70 KIAS	0.	0.
40.	RIGHT TURN, 85 KIAS	420.	970.
41.	RIGHT TURN, 105 KIAS	0.	0.
42.	RIGHT TURN, 119 KIAS	492.	1303.
43.	RIGHT TURN, 127 KIAS	0.	0.
44.	RIGHT TURN, 136 KIAS	420.	1086.
45.	TURN REVERSAL, MILD - 70 KIAS .	0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	58.	1043.
47.	TURN REVERSAL, MILD - 105 KIAS	0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.

NO.	TEST CONDITION	MEAN.	OSC.
51.	TURN REVERSAL, MOD. - 136 KIAS	232.	1332.
52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
53.	LAT. CONT. REVERSAL- 119 KIAS .	0.	0.
54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
55.	PULLUP, LEVEL FLIGHT - 70 KIAS	0.	0.
56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
57.	PULLUP, LEVEL FLIGHT- 105 KIAS	0.	0.
58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
60.	PULLUP, DIVE - 136 KIAS	0.	0.
61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
69.	AUTO PWR. RECOVERY	0.	0.
70.	APPROACH AND FLARE TO HOVER ...	0.	0.
71.	LEFT SIDESLIP - 70 KIAS	0.	0.
72.	LEFT SIDESLIP - 85 KIAS	0.	0.
73.	LEFT SIDESLIP - 136 KIAS	0.	0.
74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
77.	DIVE, STEADY - 119 KIAS	0.	0.
78.	DIVE, STEADY - 136 KIAS	0.	0.
79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
82.	DIVE, LEFT TURN - 136 KIAS ...	0.	0.
83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
87.	DIVE, PULLUP - 119 KIAS	0.	0.
88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
		0.	0.
		0.	0.
		0.	0.
		0.	0.
		0.	0.
		0.	0.
		0.	0.
		0.	0.
		0.	0.

TABLE G-2 - Continued

PARAMETER M.R. BLADE DRAG BRACE LOAD UNITS LB ENDURANCE LIMIT 5920. STATIC LIMITS +20518.,-14189.
TOGW= 8685 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	6350.	5035.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	0.	0.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	0.	0.
6.	HOVER TURN, RIGHT 30 DEG/SEC	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	0.	0.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	0.	0.	61.	AUTOROTATION ENTRY - 70 KIAS	0.	0.
12.	SIDEWARD FLIGHT - LEFT	0.	0.	62.	STAB. AUTO, 324 RPM - 70 KIAS	0.	0.
13.	REARWARD FLIGHT	0.	0.	63.	STAB. AUTO, 324 RPM - 85 KIAS	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	8029.	1089.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	7620.	1497.	65.	STAB. AUTO, 294 RPM - 85 KIAS	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	7598.	1520.	66.	STAB. AUTO, 339 RPM - 85 KIAS	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	7212.	1678.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	7122.	2041.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	6895.	2449.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	0.	0.	70.	APPROACH AND FLARE TO HOVER	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	0.	0.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS	0.	0.
33.	LEFT TURN, 70 KIAS	0.	0.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	10047.	2155.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	0.	0.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	7915.	2563.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	7167.	3175.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	0.	0.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	9957.	2472.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	0.	0.	91.	QUICK STOP -136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	7983.	3493.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	6985.	3357.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS	0.	0.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS	8119.	2767.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	0.	0.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.

TABLE G-2 - Continued

PARAMETER TEETER ANGLE UNITS DEG. ENDURANCE LIMIT STATIC LIMITS
TOGW= 8685 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.00	0.00	51.	TURN REVERSAL, MOD. - 136 KIAS	0.00	2.45
2.	NORMAL SHUTDOWN 100-0%	0.00	0.00	52.	F/A CONT. REVERSAL - 119 KIAS	0.00	0.00
3.	NORMAL TAKEOFF	0.00	0.00	53.	LAT. CONT. REVERSAL- 119 KIAS .	0.00	0.00
4.	JUMP TAKEOFF	0.00	0.00	54.	DIR. CONT. REVERSAL - 119 KIAS	0.00	0.00
5.	HOVER IGE 324 RPM	0.00	0.00	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	0.00	0.00
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.00	0.00	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.00	0.00
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.00	0.00	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	0.00	0.00
8.	HOVER, F/A REVERSAL	0.00	0.00	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.00	0.00
9.	HOVER, LAT. REVERSAL	0.00	0.00	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.00	0.00
10.	HOVER, DIR. REVERSAL	0.00	0.00	60.	PULLUP, DIVE - 136 KIAS	0.00	0.00
11.	SIDEWARD FLIGHT - RIGHT	0.00	0.00	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.00	0.00
12.	SIDEWARD FLIGHT - LEFT	0.00	0.00	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.00	0.00
13.	REARWARD FLIGHT	0.00	0.00	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.00	0.00
14.	LEVEL FLIGHT - 70 KIAS	0.00	2.29	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.00	0.00
15.	LEVEL FLIGHT - 85 KIAS	0.00	1.77	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.00	0.00
16.	LEVEL FLIGHT - 102 KIAS	0.00	1.13	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.00	0.00
17.	LEVEL FLIGHT - 119 KIAS	0.00	0.64	67.	AUTO TURN, RIGHT - 70 KIAS	0.00	0.00
18.	LEVEL FLIGHT - 127 KIAS	0.00	0.76	68.	AUTO TURN, LEFT - 70 KIAS	0.00	0.00
19.	LEVEL FLIGHT - 136 KIAS	0.00	0.68	69.	AUTO PWR. RECOVERY	0.00	0.00
20.	CLIMB, 500 FPM - 70 KIAS	0.00	0.00	70.	APPROACH AND FLARE TO HOVER ...	0.00	0.00
21.	CLIMB, 1000 FPM - 70 KIAS	0.00	0.00	71.	LEFT SIDESLIP - 70 KIAS	0.00	0.00
22.	CLIMB, 1500 FPM - 70 KIAS	0.00	0.00	72.	LEFT SIDESLIP - 85 KIAS	0.00	0.00
23.	CLIMB, 500 FPM - 85 KIAS	0.00	0.00	73.	LEFT SIDESLIP - 136 KIAS	0.00	0.00
24.	CLIMB, 1000 FPM - 85 KIAS	0.00	0.00	74.	RIGHT SIDESLIP - 70 KIAS	0.00	0.00
25.	CLIMB, 1500 FPM - 85 KIAS	0.00	0.00	75.	RIGHT SIDESLIP - 85 KIAS	0.00	0.00
26.	CLIMB, 500 FPM - 105 KIAS	0.00	0.00	76.	RIGHT SIDESLIP - 136 KIAS	0.00	0.00
27.	CLIMB, 1000 FPM - 105 KIAS	0.00	0.00	77.	DIVE, STEADY - 119 KIAS	0.00	0.00
28.	CLIMB, 500 FPM - 119 KIAS	0.00	0.00	78.	DIVE, STEADY - 136 KIAS	0.00	0.00
29.	CLIMB, MAX.RATE - 70 KIAS	0.00	0.00	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.00	0.00
30.	CLIMB, MAX.RATE - 105 KIAS	0.00	0.00	80.	DIVE, LEFT TURN - 119 KIAS	0.00	0.00
31.	CLIMB, MAX.RATE - 119 KIAS	0.00	0.00	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.00	0.00
32.	CLIMB, MAX.RATE - 136 KIAS	0.00	0.00	82.	DIVE, LEFT TURN - 136 KIAS ...	0.00	0.00
33.	LEFT TURN, 70 KIAS	0.00	0.00	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.00	0.00
34.	LEFT TURN, 85 KIAS	0.00	3.54	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.00	0.00
35.	LEFT TURN, 105 KIAS	0.00	0.00	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.00	0.00
36.	LEFT TURN, 119 KIAS	0.00	2.57	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.00	0.00
37.	LEFT TURN, 127 KIAS	0.00	0.00	87.	DIVE, PULLUP - 119 KIAS	0.00	0.00
38.	LEFT TURN, 136 KIAS	0.00	2.41	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.00	0.00
39.	RIGHT TURN, 70 KIAS	0.00	0.00	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.00	0.00
40.	RIGHT TURN, 85 KIAS	0.00	3.86	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.00	0.00
41.	RIGHT TURN, 105 KIAS	0.00	0.00	91.	QUICK STOP - 136 KIAS TO HOVER.	0.00	0.00
42.	RIGHT TURN, 119 KIAS	0.00	3.78			0.00	0.00
43.	~~RIGHT TURN, 127 KIAS~~	0.00	0.00			0.00	0.00
44.	RIGHT TURN, 136 KIAS	0.00	2.41			0.00	0.00
45.	TURN REVERSAL, MILD - 70 KIAS .	0.00	0.00			0.00	0.00
46.	TURN REVERSAL, MILD - 85 KIAS .	0.00	3.38			0.00	0.00
47.	TURN REVERSAL, MILD - 105 KIAS	0.00	0.00			0.00	0.00
48.	TURN REVERSAL, MILD - 119 KIAS	0.00	0.00			0.00	0.00
49.	TURN REVERSAL, MILD - 136 KIAS	0.00	0.00			0.00	0.00
50.	TURN REVERSAL, MOD. - 105 KIAS	0.00	0.00			0.00	0.00

TABLE G-2 - Continued

PARAMETER LATERAL ACTUATOR LOAD UNITS LB ENDURANCE LIMIT 1290. STATIC LIMITS

TOGW= 8685 LB TOCG= 192.4 IN HD= 4000 FT

NO.	TEST CONDITION	MEAN.	OSC.	NO.	TEST CONDITION	MEAN.	OSC.
1.	NORMAL START 0-100% NR	0.	0.	51.	TURN REVERSAL, MOD. - 136 KIAS	-632.	879.
2.	NORMAL SHUTDOWN 100-0%	0.	0.	52.	F/A CONT. REVERSAL - 119 KIAS	0.	0.
3.	NORMAL TAKEOFF	0.	0.	53.	LAT. CONT. REVERSAL- 119 KIAS .	0.	0.
4.	JUMP TAKEOFF	0.	0.	54.	DIR. CONT. REVERSAL - 119 KIAS	0.	0.
5.	HOVER IGE 324 RPM	0.	0.	55.	PULLUP, LEVEL FLIGHT - 70 KIAS	0.	0.
6.	HOVER TURN, RIGHT 30 DEG/SEC ..	0.	0.	56.	PULLUP, LEVEL FLIGHT - 85 KIAS	0.	0.
7.	HOVER TURN, LEFT 30 DEG/SEC ..	0.	0.	57.	PULLUP, LEVEL FLIGHT- 105 KIAS	0.	0.
8.	HOVER, F/A REVERSAL	0.	0.	58.	PULLUP, LEVEL FLIGHT- 119 KIAS	0.	0.
9.	HOVER, LAT. REVERSAL	0.	0.	59.	PULLUP, LEVEL FLIGHT- 127 KIAS	0.	0.
10.	HOVER, DIR. REVERSAL	0.	0.	60.	PULLUP, DIVE - 136 KIAS	0.	0.
11.	SIDEWARD FLIGHT - RIGHT	0.	0.	61.	AUTOROTATION ENTRY - 70 KIAS ..	0.	0.
12.	SIDEWARD FLIGHT - LEFT	0.	0.	62.	STAB. AUTO, 324 RPM - 70 KIAS .	0.	0.
13.	REARWARD FLIGHT	0.	0.	63.	STAB. AUTO, 324 RPM - 85 KIAS .	0.	0.
14.	LEVEL FLIGHT - 70 KIAS	-262.	473.	64.	STAB. AUTO, 324 RPM - 105 KIAS	0.	0.
15.	LEVEL FLIGHT - 85 KIAS	-524.	643.	65.	STAB. AUTO, 294 RPM - 85 KIAS .	0.	0.
16.	LEVEL FLIGHT - 102 KIAS	-602.	632.	66.	STAB. AUTO, 339 RPM - 85 KIAS .	0.	0.
17.	LEVEL FLIGHT - 119 KIAS	-648.	679.	67.	AUTO TURN, RIGHT - 70 KIAS	0.	0.
18.	LEVEL FLIGHT - 127 KIAS	-632.	725.	68.	AUTO TURN, LEFT - 70 KIAS	0.	0.
19.	LEVEL FLIGHT - 136 KIAS	-617.	710.	69.	AUTO PWR. RECOVERY	0.	0.
20.	CLIMB, 500 FPM - 70 KIAS	0.	0.	70.	APPROACH AND FLARE TO HOVER ...	0.	0.
21.	CLIMB, 1000 FPM - 70 KIAS	0.	0.	71.	LEFT SIDESLIP - 70 KIAS	0.	0.
22.	CLIMB, 1500 FPM - 70 KIAS	0.	0.	72.	LEFT SIDESLIP - 85 KIAS	0.	0.
23.	CLIMB, 500 FPM - 85 KIAS	0.	0.	73.	LEFT SIDESLIP - 136 KIAS	0.	0.
24.	CLIMB, 1000 FPM - 85 KIAS	0.	0.	74.	RIGHT SIDESLIP - 70 KIAS	0.	0.
25.	CLIMB, 1500 FPM - 85 KIAS	0.	0.	75.	RIGHT SIDESLIP - 85 KIAS	0.	0.
26.	CLIMB, 500 FPM - 105 KIAS	0.	0.	76.	RIGHT SIDESLIP - 136 KIAS	0.	0.
27.	CLIMB, 1000 FPM - 105 KIAS	0.	0.	77.	DIVE, STEADY - 119 KIAS	0.	0.
28.	CLIMB, 500 FPM - 119 KIAS	0.	0.	78.	DIVE, STEADY - 136 KIAS	0.	0.
29.	CLIMB, MAX.RATE - 70 KIAS	0.	0.	79.	DIVE, RIGHT TURN - 119 KIAS ...	0.	0.
30.	CLIMB, MAX.RATE - 105 KIAS	0.	0.	80.	DIVE, LEFT TURN - 119 KIAS	0.	0.
31.	CLIMB, MAX.RATE - 119 KIAS	0.	0.	81.	DIVE, RIGHT TURN - 136 KIAS ...	0.	0.
32.	CLIMB, MAX.RATE - 136 KIAS	0.	0.	82.	DIVE, LEFT TURN - 136 KIAS ...	0.	0.
33.	LEFT TURN, 70 KIAS	0.	0.	83.	DIVE, RT. TURN PULLUP- 119 KIAS	0.	0.
34.	LEFT TURN, 85 KIAS	-293.	910.	84.	DIVE, LT. TURN PULLUP- 119 KIAS	0.	0.
35.	LEFT TURN, 105 KIAS	0.	0.	85.	DIVE, RT. TURN PULLUP- 136 KIAS	0.	0.
36.	LEFT TURN, 119 KIAS	-694.	848.	86.	DIVE, LT. TURN PULLUP- 136 KIAS	0.	0.
37.	LEFT TURN, 127 KIAS	0.	0.	87.	DIVE, PULLUP - 119 KIAS	0.	0.
38.	LEFT TURN, 136 KIAS	-617.	740.	88.	CLIMB, MAX. RATE, PUSHOVER- 70	0.	0.
39.	RIGHT TURN, 70 KIAS	0.	0.	89.	CLIMB, MAX. RATE, PUSHOVER- 136	0.	0.
40.	RIGHT TURN, 85 KIAS	-355.	1095.	90.	CLIMB, MAX. RATE, PUSHOVER- 65	0.	0.
41.	RIGHT TURN, 105 KIAS	0.	0.	91.	QUICK STOP - 136 KIAS TO HOVER.	0.	0.
42.	RIGHT TURN, 119 KIAS	-833.	1111.			0.	0.
43.	RIGHT TURN, 127 KIAS	0.	0.			0.	0.
44.	RIGHT TURN, 136 KIAS	-679.	771.			0.	0.
45.	TURN REVERSAL, MILD - 70 KIAS .	0.	0.			0.	0.
46.	TURN REVERSAL, MILD - 85 KIAS .	-648.	987.			0.	0.
47.	TURN REVERSAL, MILD - 105 KIAS	0.	0.			0.	0.
48.	TURN REVERSAL, MILD - 119 KIAS	0.	0.			0.	0.
49.	TURN REVERSAL, MILD - 136 KIAS	0.	0.			0.	0.
50.	TURN REVERSAL, MOD. - 105 KIAS	0.	0.			0.	0.